SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLIII.—No. 13. [NEW SERIES.] NEW YORK, SEPTEMBER 25, 1880. [$3.20 per Annum. [POSTAGE PREPAID.]

NEW CAB.

The cab shown in the annexed engraving presents many points of novelty, among which are the iron frame, the peculiar form of the running gear, and the springs. The weight of the vehicle is only 775 lb.; this, together with the closeness of the coupling connections, renders the draught very light. It is capable of turning in its own length, and its body is so low and the step is so conveniently arranged that it is very easy to get into or out of the cab. The form of the springs and their connection with the body and with the running gear are well calculated to render it very easy riding.

The large perspective view shows the cab complete, while parts of the running gear are shown in detail in the other figures. Fig. 2 is a plan view, and Fig. 3 a side elevation of the running gear.

The forward axle, A, supports a pair of curved springs, B, which are at the ends, to opposite sides of the frame, C, which is stayed by crossed braces, D, attached to the axle and to the rear of the frame at the corners. The frame, C, is composed entirely of T and angle iron, and supports the fifth wheel, E. The frame which supports the front of the body is also made of T and angle iron riveted and bolted together, forming a very rigid yet very light support.

Perhaps the greatest novelty found in the cab is the method of supporting the body on the rear axle by means of the curved springs shown in Figs. 3 and 4. These springs are novel both as to their form and construction.

The main portion consists of a continuous blade or strip, which is bent so as to form an eye for attachment to the bar or rail secured to the cab body. The two leaves which are formed by bending the steel strip back upon itself are curved upward and forward, forming a loop for receiving the suspension stirrup supporting the vehicle body. The two leaves thus formed are in close contact with each other at or near their junction with the rear axle, but they gradually separate as they extend rearward and upward, and then approach each other again, forming the loop for the suspension stirrup. The extremity of the upper portion of the spring is increased in thickness, forming a butt, which is engaged by a clip on the rear axle which prevents the upper leaf from sliding, and also secures the entire spring firmly to the axle. For light carriages the spring shown in Fig. 3 is used, but when the load is increased additional leaves are placed under it, as shown in Fig. 4.

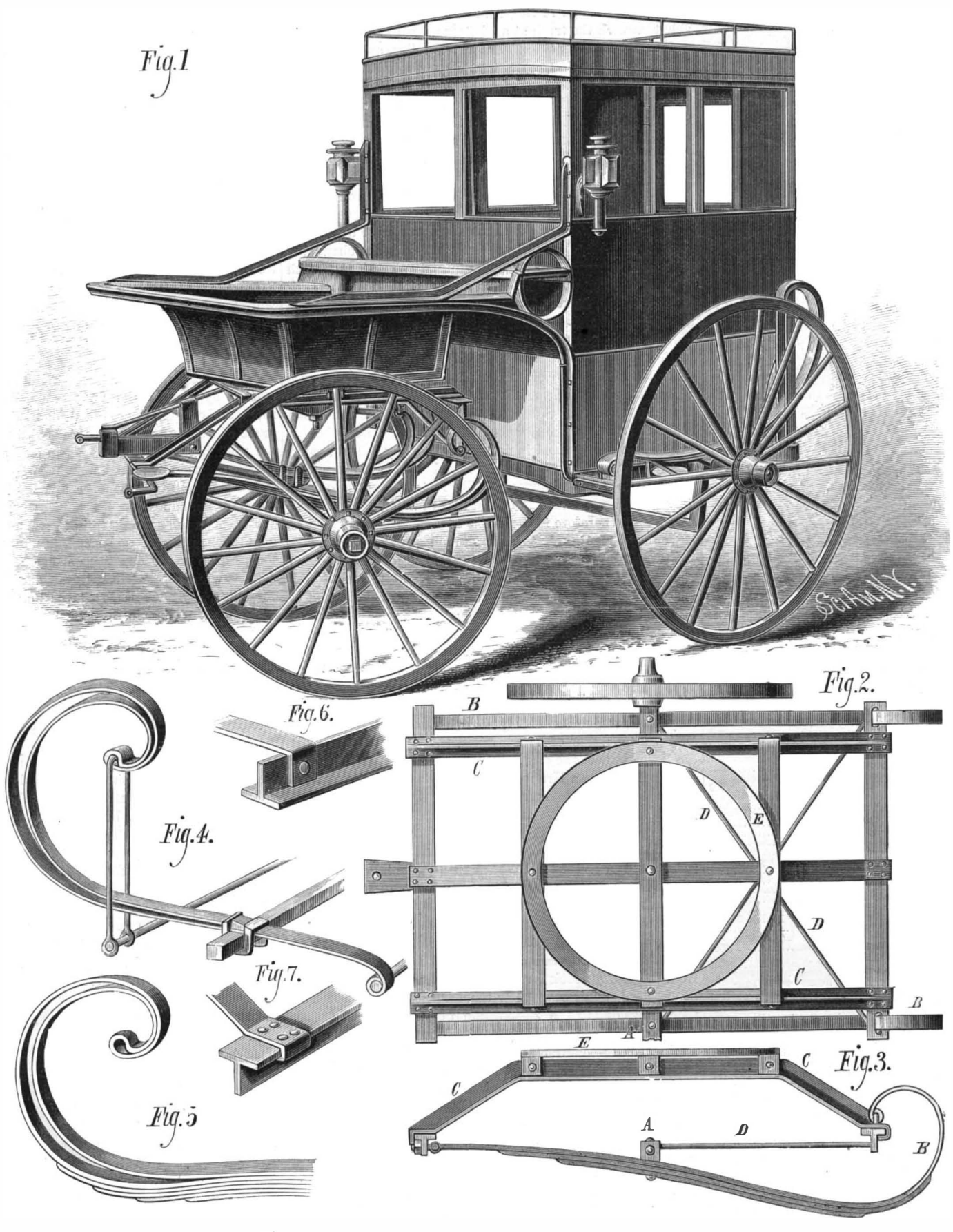
The method of fastening together the bars forming the running gear is shown in Figs. 5 and 6, and the method of attaching the pole socket and thill fastenings is clearly shown in Fig. 1. The vehicle is adapted for either pole or thills.

This cab is capable of carrying from four to six persons with their baggage. The heavy baggage is carried on the boot or front frame, which is 4 x 4 feet square and arranged so that the baggage can be readily strapped on. The lighter baggage may be carried on the top of the cab.

For simplicity, strength, lightness, and ease in riding, this cab is believed to be unexcelled. It is well adapted for common use and for hotels, and one horse can easily draw it anywhere with its load of five or six persons and their baggage.

The inventor has recently taken several patents for the improvements embodied in this vehicle.

Further particulars may be obtained by addressing the patentee and manufacturer, Mr. C. M. Murch, of Cincinnati, O.



MURCH'S CHARIOT CAB.

The Platts-mouth Bridge.

A fine steel bridge across the Missouri River, about a mile below Platts-mouth, Neb., on the Chicago, Burlington, and Quincy Railroad, was opened for business August 30. The whole length of the work is about three and a half miles, of which more than two miles is in the east approach, one mile is in the west approach, and the permanent steel bridge is just 3,000 feet long. Previous to the formal opening of this imposing structure it was subjected to a crucial test in the presence of a large number of civil engineers and bridge builders from all parts of the country. With a combined weight of eight heavy engines, 450 tons were run on the bridge. The measure showed a deflection of about three inches. This is considered a highly satisfactory test and a less deflection than was expected. The cost is $600.000.

Welding Horn

Pieces of horn may be joined by heating the edges until they are quite soft, and pressing them together until they are cold.

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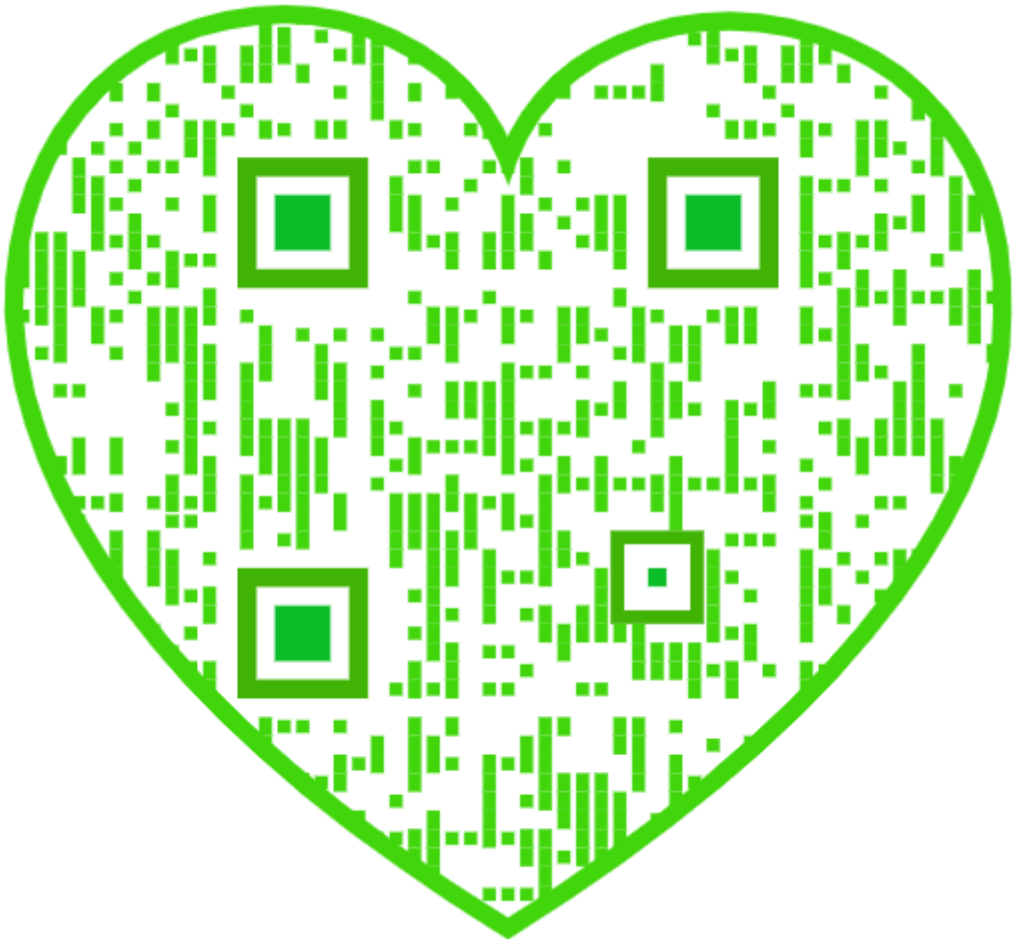

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

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One copy, six months, postage included 1 60

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NEW YORK, SATURDAY, SEPTEMBER 25, 1880

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COULD A HOSTILE FLEET BOMBARD NEW YORK?

In these days of modern ordnance, when rifled guns can send missiles weighing nearly a ton to distances never contemplated at the time when most of our harbor defense systems were projected, the question cannot fail to arise: Is New York safe from bombardment by a hostile fleet? England, France, Germany, or Italy, could concentrate a dozen heavy iron clads off Sandy Hook within three weeks of a declaration of war, and as we have absolutely no ships whatever to meet them at sea, we should have to depend upon our coast defenses and torpedoes for protection. Are our defenses sufficient to save our sea-coast cities from bombardment?

In view of the enormous ranges obtained by Herr Krupp with his new rifled breech-loading guns, the question also arises whether New York could not be shelled from the open sea, where the enemy would be far beyond the effective range of our forts. In the first place, how far can shells be thrown? For the purpose of bombarding a city it is unimportant that the aim should be accurate. New York could be terribly injured by any kind of stray firing, irrespective of the enemy's capacity to single out particular buildings as targets. But the Krupp guns have shown an extraordinary accuracy at long ranges. The 3½ and 4½ inch guns have given accurate results as high as 9,057 yards, the lateral deviation at this distance being less than 60 yards. Their extreme range, so far as any records have been made public, has not exceeded 11,000 meters, about 11,900 yards, or 6·8 miles. But it is claimed that the larger guns, from 8 inches to 15·75 inches in calibre, will give a much greater range. During our civil war General Gillmore threw shells from a 300 lb. Parrott gun into Charleston, a distance of eight miles. At the Centennial Exhibition in Philadelphia, Herr Krupp exhibited a 12-inch gun bearing the modest inscription: "Range 15 English miles." Probably it is allowable to stretch the truth at an International Exhibition, and so it is not unreasonable to allow ten miles as the outside limit of this gun's range. But Krupp's latest gun, 15·75 inches caliber, throwing a solid shot of 1,760 lb. weight, may very likely exceed even ten miles. In like manner the famous 100-ton guns furnished to the Italian government by Sir William Armstrong may have a range proportionate to their immense size, in which case 12 miles would not be an extravagant estimate for them.

Now let us examine the chart of the sea coast around New York Bay. There are three channels from the open sea to the Narrows. The main entrance passes close under the guns of an unfinished fort on Sandy Hook. The channel is deep and comparatively constant in depth. The Swash channel is about two miles from the Sandy Hook fort, and, at low tide, its depth will not permit the entrance of a vessel drawing more than 24 feet. The third channel is far distant from the fort, but it has a depth of only 14 feet. Now, while every effort would be made, by using torpedoes and other obstructions, to close the main and Swash channels against an enemy's fleet, it is not impossible that an entrance should be effected. Since torpedoes are available only when covered by heavy fire from guns on shore or on shipboard, the ships could proceed in comparative safety, after passing Sandy Hook, until they approached Forts Hamilton and Wadsworth at the Narrows. The fort at Sandy Hook is only half begun, and it is of old and almost obsolete character, and therefore in the event of a hastily declared war it would not be likely to afford much protection. Hence the probability of a fleet passing has been considered; but it is far different at the Narrows. Without going into the particulars of the armaments of these forts it is sufficient to say that there are no vessels afloat that could approach nearer than one-half of a mile to these forts without being sunk by torpedoes, unless some skillful inventor shall devise a hitherto unthought of protection against these hidden and deadly machines. But at the distance mentioned the ships would be only seven miles from the battery, and if they could maintain their position there, and if they had guns with a range of eight miles, they could easily bring the lower part of the city to grief.

Assuming that a Krupp 71-ton gun was used, throwing a shell of 1,760 lb., containing a charge of 73 lb. of powder, the destruction would soon reach into the millions. One such shell exploding in a warehouse would wreck it from cellar to roof. Since it is very probable that a range of eight miles will be obtained in the near future, the invulnerability of the city in this direction depends upon the fort at Sandy Hook and the efficiency of our torpedo system.

But there is another direction whence the city could be reached if guns can be invented of sufficient range. From the Battery to the sea beach of Long Island, seven miles from the Sandy Hook fort and five miles east of Fort Hamilton, the distance is exactly ten miles, and one mile further brings one to the 25-foot line of soundings. In other words an iron-clad drawing twenty-four feet of water can approach within eleven miles of the Battery without exposing herself to the slightest danger of even being fired at. Consequently it needs only a gun to carry twelve miles to place the whole of Brooklyn and the wealthiest part of New York at the mercy of an enemy. Such a gun is not only possible but extremely probable; and, in view of the helpless position in which we should then be placed, in the absence of any navy to take the offensive, it might be well for our business men to take thought for the future by asking Congress to give them some form of protection in the event of war. It opens the widest field for the inventive genius of this country to exert itself to devise such protection.

SCIENCE TEACHING IN SCHOOLS.

The Report of the Committee on Science Teaching in Schools, signed by Professors E. L. Youmans, A. R. Grote, J. W. Powell, and J. S. Newberry, and read before the American Science Association by Dr. Youmans, is a severe but not unjust arraignment of the unscientific methods by which science is usually mistaught in schools. The chief aim of the committee was to inquire how far the public school system has availed itself of the valuable aid which science offers in the proper cultivation of the minds of the young. The association aims to advance science by the promotion of original investigation, and is naturally interested to know whether the methods of the schools favor or hinder genuine scientific study; whether they foster the early mental tendencies that lead to original thought, or thwart and repress them.

That the latter is generally the case is only too evident; yet in every school the belief is that science is taught, and taught scientifically. The reason why fact does not conform to theory in this matter may be found in the single circumstance that the majority of teachers are untrained or contra-trained for scientific thinking, while the few who could be and would be glad to be scientific in their methods of teaching are prevented by the fixed requirements of the schools as developed on examination day. In the words of the committee, the old idea of a school is a place "where knowledge is got from books by the help of teachers, and our public school system grew up in conformity with this ideal. The early effect of grading was to fix and consolidate irrational methods. The sciences were dissimilated to the old practice, and the science teaching falls short at just the points where it was inevitable that it should fall short. The methods of school teaching and the habits of the teachers had grown rigid under the regime of book studies. As a consequence, the science teaching in the public schools is carried on by instruction. Through books and teachers the pupil is filled up with information in regard to science. Its facts and principles are explained as far as possible, and then left in the memory with the other school acquisitions. He learns the sciences as he learns geography and history. He is not put to any direct mental work upon the subjects of science, or taught to think for himself. As thus treated, the sciences have but little value in education. They fall below other studies as means of mental cultivation. Arithmetic rouses mental reaction. The rational study of language, by analytical and constructive tasks, strengthens the mental processes; but the sciences are passively acquired in their results. This is not scientific education, because there is no practice in the scientific method. Science, as a means of training the faculties, in the various ways to which they are severally adapted, is not taught in the public schools. It is not made the means of cultivating the observing powers, or of stimulating inquiry, or of exercising the judgment in weighing evidence, or of forming original and independent habits of thought. As remarked by Agassiz, the 'pupil studies nature in the school room, and when he goes out of doors cannot find her.' This mode of teaching science, which is by no means confined to the public schools, has been condemned in the most unsparing manner by all eminent men of science as a deception, a fraud, an outrage upon the minds of the young, and an imposture in education."

Futher on the committee justly remark that the failure to gain the benefits of real scientific study seems to have its source deep in the constitution of the public schools. In dealing with masses of children classification became necessary, which gave rise to grading and an elaborate mechanical system. The working of children in lots is a great convenience to the teacher, but it strengthens the method of verbal instruction, recitations, and lesson-giving. It is well fitted to impress the public with the idea that there is much done in the schools. There is a prescribed routine of operations and a display of order that is admired. But teacher and learner are subordinated to the system. It is machine work, and the machines make no allowances. Graduation assumes and enforces a uniformity among pupils that is false to the facts. Wide personal differences of capacity, aptitude, attainment, and opportunity not only exist among children, but they are the prime data of all efficient mental cultivation. In the graded schools, just in proportion to the perfection of the mechanical arrangements, individuality disappears; and with individuality goes originality. Science, if rightly pursued, is the most valuable school of self-instruction. From the beginning men of science have been self-dependent and self-reliant, because self-taught. They have been more hindered than helped by the schools. De Candolle, in his valuable book on the conditions which favor the production of scientific men, says that the discoverers, the masters of scientific method, have chiefly appeared in small towns where educational resources have been scanty, and that they have often been most helped by the poorness of their teaching, which means that the schools were not so perfect as to kill out all originality.

Where there is any cure for this state of things, whether it is possible for the lower schools to teach science scientifically, the committee does not say. The truth is education and schooling are and always have been radically at variance, meaning by education an orderly growth in right mental habits through the reasonable attainment of exact knowledge. In the child world there is no science; and the attempt to cram boys and girls with scientific information—science teaching as commonly understood and practiced—is

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necessarily fatal to the habit of scientific thinking. On the other hand, if the teacher is to be simply the guide of pupils in their pursuit of real knowledge, in their scientific exploration of the world that lies next to them in space, and in their scope of intelligence, the public must be content with a plentiful lack on the part of their children of the conventional information by which parents judge of the instruction and education of children. Until parents have a truer idea of what knowledge is most worth there can be little hope of radical improvement in this part of school work.

A CHANCE FOR INVENTORS.—THE $5,000 CAR.

Our readers will remember that a prize of $5,000 was offered last year by the American Humane Association for a cattle car so constructed as to allow cattle to lie down while in transit, and to be fed and watered while in the cars. This to prevent the suffering caused by long standing and the injury and delay incident to unloading and reloading. The president of the association, Mr. Edwin Lee Brown, announces in a circular that the money has been pledged and nearly all of it paid over to the secretary of the association and deposited with trustworthy bankers. All competitors for the prize are required to send their models and plans, with full descriptions, to Mr. Brown, corner Clinton and Jackson streets, Chicago, Ill., before the 1st day of October next. All communications with regard to the prize should also be addressed to Mr. Brown.

The judges appointed are Edwin Lee Brown, Chicago, Ill.; John B. Winslow, Boston, Mass.; A. Kimball, Davenport, Ia.; William Monroe, Brighton, Mass.; E. T. Jeffery, Chicago, Ill.

The judges do not prescribe the size or the internal arrangement of the needed car; but among plans which meet the conditions, that will have the preference which can most readily and cheaply be adapted to the cattle car now in use. Of course, also, that car which can be most easily adapted to the transportation of other live animals and merchandise, if in other respects satisfactory, will have the preference.

It is expected that competitors will take out patents for their inventions, before submitting them, or not, as each shall choose; but the judges must be fully satisfied of the legal title of a claimant to his invention, before awarding to him the prize, or any part of it. The prize winner must also convey to the American Humane Association, or to such persons as its Executive Committee shall designate, a patent for the United States and Canada of the invention, which shall be satisfactory to said committee, before any part of the prize money will be due to him.

As models and plans may be seen by others than the judges while in their possession, they suggest, as a precautionary measure, that each inventor file a caveat at the United States Patent Office before sending them.

The East River Bridge.

The first consignment of steel—27,460 pounds—for the superstructure of the East River Bridge has been received, and rapid deliveries are expected from this time on, the Edgemoor Iron Company having put its full force upon this contract. The guys of the superstructure, manufactured by the Roeblings at Trenton, of Bessemer steel, have also arrived. The Cambria Steel Company, which furnishes the steel, has about a thousand tons ahead of the Edgemoor Company. Colonel Paine reports that the steel has all been tested and is of superior quality, the strength of the steel trusses being six times greater than is likely to be required.

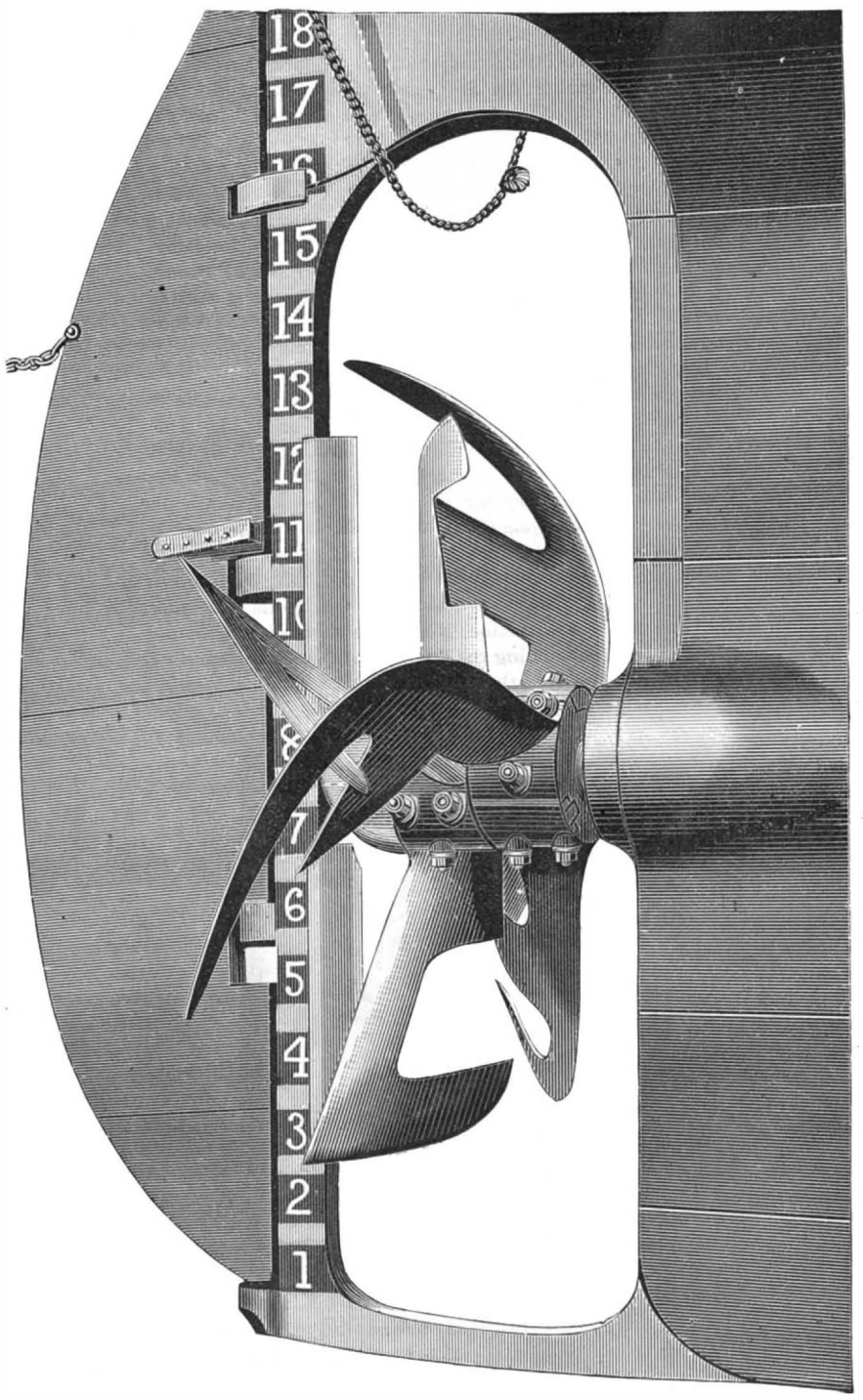
The last structure to be razed to make room for the New York approach will soon be cleared away. Thus far the bridge has cost $14,000,000—of which sum $3,000,000 went under water and $4,000,000 went for real estate, to be covered by a mile of costly masonry. In the profile drawing of the completed structure the lofty towers sink to comparative insignificance. The projection carries in the observer's mind a sense of length rather than of height. The superb arches at Vandewater and Rose and William and North William streets, the massive anchorages at Franklin square in New York and Main street in Brooklyn, and the airy bridge over Pearl street become, says a critical observer, more conspicuous in this picture than are the towers, which are so imposing as seen at midstream on the East River.

It is calculated that with the greatest possible weight on the bridge and in the hottest of August days, with the tide at its highest, there will be 135 feet 6 inches in the clear between the lowest point in the bridge, midstream, and the surface of the East River.

THE production of Bessemer steel rails in the United States in 1869 was 2,550 tons; in 1878, 550,398 tons, and 9,307 tons of open-hearth steel rails in addition.

THE DE BAY PROPELLER.

The De Bay propeller, an English invention, which has attracted much attention since its efficiency was made public by a series of experiments in 1879, has recently been fitted to a steamship of a sufficient size to give a decided test of its value. The Cora Maria, a steamer of 831 tons net register and 2,800 tons displacement, was the vessel used for the experiments. Her dimensions are: Length, 235 feet; breadth, 31 feet; depth, 18 feet 3 inches. Her engines are of the compound inverted cylinder and surface condensing type, the high pressure cylinder being 28 inches, and the low pressure cylinder being 54 inches in diameter, with a stroke of 3 feet. The screw used in the first experiment was an ordinary four-bladed screw, having a diameter of 13 feet 2½ inches, and a pitch of 19 feet 6 inches. With this screw a trial was made over a course of two and one-fifth knots on the 10th of July last, and then the De Bay gearing and propeller (diameter 11 feet) were fitted to the vessel and a trial was made under exactly similar conditions on the 10th of August. The results obtained from each trial are herewith tabulated for comparison, it being understood that in each case four runs over the course were made, the first and third being with the tide and the second and fourth against it.



THE DE BAY PROPELLER.—THE TWO HUBS WITH THEIR BLADES MOVE IN CONTRARY DIRECTIONS.

	Ordinary screw.	De Bay propeller.
Average revolutions per minute	66·32	65
Average steam pressure, pounds	74·7	74·5
Average vacuum, inches	25·58	24·25
Indicated horse power	584·51	585

TIME.

	First course.	Second.	Third.	Fourth.
Ordinary screw	12m. 5s.	20m. 27s.	12m. 3s.	19m. 56s.
De Bay propeller.	9m. 4s.	16m. 42s.	9m. 6s.	16m. 10s.

SPEED IN KNOTS PER HOUR.

	First course.	Second.	Third.	Fourth.
Ordinary screw	10·924	6·45	10·954	6·62
De Bay propeller	14·557	7·898	14·505	8·162

TURNING THE CIRCLE.

	Ordinary screw.	De Bay propeller.
To port	4m. 44s.	4m. 33s.
To starboard	6m. 51s.	5m. 4s.

The mean speed obtained on each trial was 8·73 knots for the ordinary screw and 11·28 knots for the De Bay propeller, or an actual gain for the latter of over 29 per cent for the same expenditure of power. Assuming that the resistance varies as the cube of the speed (and practically this ratio is greatly exceeded), since it required 584·51 horse power to drive the Cora Maria at a mean speed of 8·73 knots with the ordinary screw, it would have required 1,256·69 horse power to drive her at the speed of 11·28 knots obtained by the De Bay propeller. We might easily go on to calculate the immense saving in fuel thus obtained, but the foregoing figures are sufficient to call attention to the advantages of the new propeller.

With the ordinary screw there is, as every one knows, a great deal of vibration, and the stern of a screw steamer shakes and quivers very unpleasantly; while the De Bay invention produces no local commotion at all.

Since the first trial in 1879 the shape of the larger half of the propeller blades has been somewhat altered. Formerly they were designed so that they nearly filled up a segment of a circle having the same diameter as the propeller. They now have a curved form in place of an angle, and each blade, instead of a uniformly increasing pitch, has a pitch of 17 feet to half radius, increasing therefrom to a pitch of 19 feet to 21 feet.

The Cora Maria is now on a voyage to Alexandria, Egypt, with a full cargo, and the reports of her captain and engineer will be awaited with great interest.

TRAVELING FLIES.

On the afternoon of Saturday, September 4, the steamboat Martin encountered, on the Hudson River, between New Hamburg and Newburg, a vast cloud of flies. It reached southward from shore to shore as far as the eye could reach, and resembled a great drift of black snow. The insects were flying northward "as thick as snow flakes driven by a strong wind." The steamer Mary Powell ran into the fly storm off Haverstraw, some forty miles below where the Martin encountered it. The flies were "long and black and had light wings."

A dispatch from Halifax, Nova Scotia, states that on Sunday, Sept. 5, immense swarms of flies passed over Guysboro, 120 miles northeastward of Halifax. They came from the east and resembled a dark cloud.

A correspondent of the Toronto *Mail*, writing from East Pictou, Nova Scotia, describes a similar phenomenon as occurring there August 21. The flies, forming a veritable cloud, passed Lismore at 6 o'clock in the evening, close to the shore. They went with the wind, which was blowing lightly from the west, occupying about twenty minutes passing a given point. They made a loud, buzzing noise, which was heard by many who missed seeing them. They flew so low that some of them appeared to fall into the water. About two miles below Lismore they slightly changed their flight, heading more to the north. After their passage numbers of strange flies were observed in some of the houses near the shore. They were about half an inch in length, with wings proportionately longer than those of the common house fly, but whether they belonged to the swarm is uncertain.

In none of these American reports are the flies mentioned as biting, like the swarm of flies which invaded the port of Havre, France, a few weeks ago. From the indefinite descriptions given of them it seems possible that the American flies may have been ichneumon flies, which have had an exceptionally favorable season for multiplication, owing to the multitudes of army worms in which they deposit their eggs.

American Glass Making.

The first glass factory in America was erected in 1609 near Jamestown, Va., and the second followed in the same colony twelve years later. In 1639 some acres of ground were granted to glassmen in Salem, Mass., probably the first year of the industry which was prosecuted there for many years. The first glass factory in Pennsylvania was built near Philadelphia in 1683, under the direction of Wm. Penn, but it did not prove successful. The first glass factory west of the Alleghenies was set up by Albert Gallatin and his associates in 1785, at New Geneva, on the Monongahela River. A small factory was established on the Ohio River, near Pittsburg, in 1790, and another in 1795. The earlier attempt failed, the later was quite successful. In 1810 there were twenty-two glass factories in the country, with an annual product valued at $1,047,000. There are now about five times as many factories, producing eight times as much glass. According to the returns received under the recent census, our flint glass factories turn out 210,554 tons of table and other glassware; and the window-glass works produce 2,644,440 boxes. The total value of the product is nearly $45,750,000.

The Anglo-American Telegraph Company.

This company has lately laid a new cable between Ireland and Newfoundland, and now has four separate cables in operation. By the use of the new duplex system the directors report that they are able to do as much business on these four cables as could formerly have been done on eight cables.

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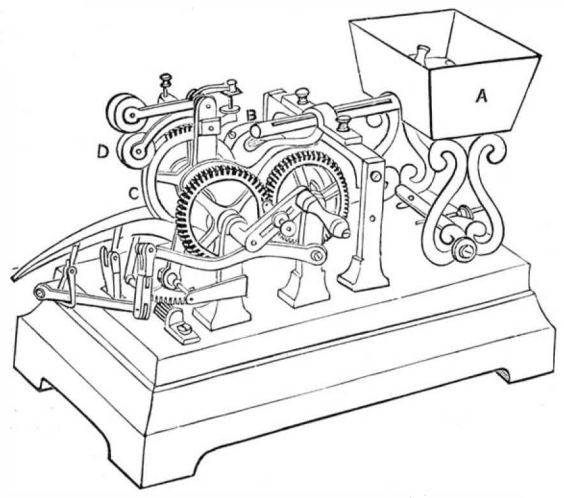
FRENCH PILL PRINTING MACHINE.

The engraving shows a pill printing machine invented by M. Vial, of Paris. The pills, first coated, are placed in the hopper, A, and are conducted thence, one by one, along a small groove to B, where they drop through a cylinder to another groove. At a certain point in their passage they are brought in contact with a wheel, C, which is being turned by the operator. On the outer rim of the wheel the type is fixed, it is inked from little rubber cylinders, D, as it revolves, and the pill meets the wheel just as the type approaches. It receives the impression in beautifully clear characters, and is henceforth unmistakable as to its properties, no matter in what company it may ultimately find itself.



PILL PRINTING MACHINE.

A Model Foreman.

The following, from the *Manufacturer and Builder*, contains not only good advice to the class of persons to whom it is addressed, and to which they will do well to heed, but to the manufacturer it suggests some of the qualifications a foreman should possess to insure harmony and good feeling among the workmen:

He will not discharge a good workman for a slight offense, and retain the poorest men. A good foreman (instead of giving his order to a man verbally and imperfectly) will always carry a sketch block or pad in his pocket, and where drawings are not used, will give his orders on paper, together with a rough pencil sketch if required. He should then require the workmen to file away those orders, thus putting him in the possession of the necessary evidence to defend himself in case there should be any fault with the work when completed.

A foreman should realize that his workmen are entitled to his respect, and he should conduct himself in such a manner that when he moves about among his men they will feel in duty bound to show him all the courtesy which pertains to his position. His personal habits should be such as may with profit be imitated by every man in the shop. If a workman gets into trouble over a piece of work, a kind and sympathetic foreman will always help such a person out of his difficulty.

It is wise for a foreman to employ only the best language toward his men, for the use of profanity not only creates an enmity between the foreman and the workman, but also destroys the ambition and interest which the latter should always manifest in his work.

A foreman should be systematic, and wherever a standard or a certain routine can be applied to any branch of the work it should be done. Tools, instead of being left scattered over the floor, should each have a particular place. Thus, both the foreman and workman are saved the aggravating annoyance of searching for these tools.

When a piece of work is given to a mechanic he should always be allowed to finish it, for one of the most disagreeable things, and also one of the most humiliating to the workman, is to commence a piece of work and then have the foreman to take it to some one else to finish.

Finally, a model foreman should endeavor to make himself so useful to his employers that they cannot well do without him, taking the same interest in managing the shop and studying economy with as much care as if his own capital were invested in the business. The manufacturing world are looking for artisans of this kind, and any person who has followed the opposite plan will, by adopting the principles herewith outlined, be agreeably surprised in a short time that he can make progress with so much greater satisfaction to himself than ever before.

A Novel Horseshoe.

A Berlin manufacturer is making a horseshoe of iron and hemp that is receiving considerable favor among the Germans. The shoe is of malleable iron carrying a deep wide groove, into which tarred hemp rope is firmly wedged. The rope is so thick that it protrudes beyond the rim of iron. The shoe is very light, and is said to be serviceable.

A Large Ingot of Steel.

There was cast recently at the Norway Iron Works, South Boston, an ingot of steel 10 feet 4 inches long, 24 inches square at one end, and 26 inches square at the other. It weighed 19,000 pounds, exceeding by some 9,000 pounds the largest casting of the sort previously made. The mould, which was of cast iron and weighed 13,700 pounds, was constructed by the Bridgewater Iron Company. The ingot is to form a part of a pumping engine now being made by the Bridgewater Company for the Calumet and Hecla Mining Company.

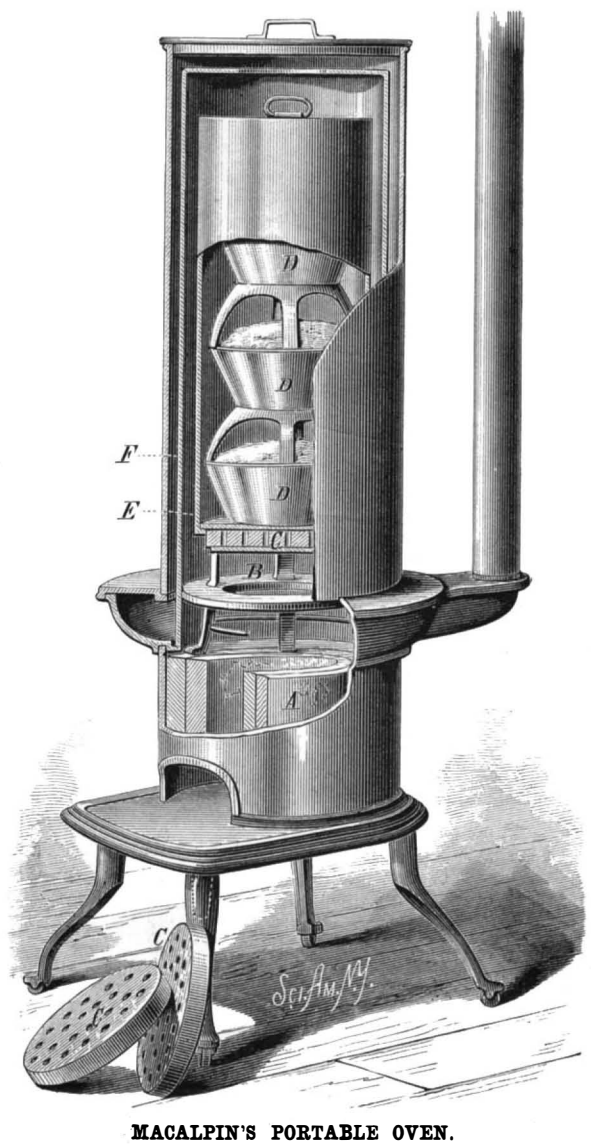
NEW PORTABLE OVEN.

It is generally admitted that for some culinary operations the ordinary cook-stove and range are neither effective nor economical, and it has been determined by actual experiment that in the matter of baking, ordinary stoves are wasteful of both fuel and time.

The new portable oven shown in the engraving is designed to be used in connection with an ordinary portable furnace, and is not only capable of baking with a small amount of fuel, but it also prevents the dissemination of odors from the articles being cooked. The inventor contracts the fire pot of an ordinary portable furnace by inserting an extra lining, A, of fire brick; this serves the double purpose of materially reducing the fire space and of preventing the radiation of heat into the room—a very desirable feature in warm weather.

The top plate of the furnace has the usual opening for the reception of cooking vessels. To this opening is fitted a cylindrical casing, closed at the top by a removable cap, and to a flange surrounding the upper edge of the fire pot is fitted a cylinder concentric with the outer cylinder, forming between the two a flue, F. The inner cylinder has a central opening at the top, so that the products of combustion may pass upward in the inner cylinder, and downward in the flue, F, to the chimney flue.

An annular plate, B, and a plate, C, of refractory material are supported by legs which rest on the fire brick, A. The pans, D, which contain the dough, are supported one above another on the plate, C, the several pans are separated by light frames, and they are all inclosed by a cylindrical casing which rests upon the plate, C. By this arrangement the full effects of the fresh products of combustion is utilized in heating the inner casing and its contents, there being very little loss of heat by radiation, owing to the fact that the products of combustion, which pass upward around the inner casing, descending the flue, F, form an effectual air-jacket which prevents the chilling of the oven.



MACALPIN'S PORTABLE OVEN.

The design of the inventor is to concentrate and make use of all of the heat from the fire, so that none of it shall pass up the chimney and be wasted, and at the same time to have such control of it as to permit more or less of it to escape into the room as may be desired, and to carry off all offensive odors and smoke which commonly escape into the room when cooking is done in the usual way. Either coal or gas may be used as fuel. The oven is made in different sizes, large ones being made for hotels and bakeries.

The oven is raised from the furnace by cords or chains passing over pulleys in the ceiling, with counterbalance weights at the end.

These ovens may be adapted to broiling, frying, or cake making. We are informed by the inventor that a loaf of bread weighing two pounds two ounces has been baked in one of these ovens in thirty-two minutes, and that eight and a half pounds of bread can be baked in the same length of time.

This invention was recently patented by Mr. Daniel MacAlpin, 2041 Ridge avenue, Philadelphia, Pa., who should be addressed for further information.

HENS' WIRE NESTS.

It is a well known fact that straw or hay nests or basket nets for setting hens cannot be kept free of vermin. The

IMPROVED HEN'S NEST.

annexed, illustration, which we take from the *Leipziger Illustrirte Zeitung*, shows a very practical and simple nest. It is made of wire netting, and is filled with hay or straw, which can be removed and replaced with fresh material very conveniently. As the air can circulate through the nest quite freely vermin are not apt to infest the nest. It is also stated that it is well to pour petroluum on the bars or rods of a chicken coop so that the petroleum will spread on the feet of the fowls, so that when they scratch themselves they will bring the petroleum in contact with the body, dispersing the vermin.

Railway Ties and Telegraph Poles.

But few people comparatively have any idea of the amount of timber used in the construction of a single railroad. We hear that our forests are rapidly disappearing, and we know that material for building and fuel causes the sacrifice of many leafy monarchs of the forest; yet only the initiated knows that it yearly takes 200,000 acres of forests to supply cross-ties for the railroads of the United States. We interviewed a gentleman who has been in the business for thirteen years, and concluding that his observations and experience would be of interest, we give the substance of his talk: It takes 15,000,000 ties to supply the demand on our railroads, for which, on an average, the contractors get 35 cents apiece, making in the aggregate $5,250,000. In building a new road the contractors figure on 2,700 ties to the mile, while it takes 300 ties to the mile to keep a constructed road in repair. Contractors, of course, buy pieces of timber land as near to the proposed line of road as possible, paying for the timber an average of $20 per acre, or giving the proprietor of the land 10 cents for every tie got out. The average of a good piece of timber land is 200 trees to the acre and 12 ties to the tree.

The size of a cross-tie differs on different roads, but the usual size demanded is 8 feet 6 inches long and 8 inches face. White or burr oak is considered the best timber for the purpose, although cherry, maple, ash, and even locust have been used. The last named were first used on the Little Miami Railroad, and after a time thrown aside as unfit for the purpose. Railroad men much prefer ties hewn out with an ax to those sawed in a mill, and many contend that the first named will considerably outlast the sawed ties. This theory is probably a fallacy, as sawed ties have been placed alongside of hewn ties, and remained sound twice as long. This business gives employment to an army of choppers, who are paid 10 cents apiece for each tie. A continued practice makes the choppers expert in the use of the ax, and a single man has been known to get out 35 ties in a day; yet the average is only 10, while an expert will probably get out 20. During the war, when ties sold at from 50 to 65 cents, choppers were paid 12½ cents apiece. Although the contractor gets 35 cents apiece from the railroads for each tie, still there is a loss of from 5 to 7 per cent on dockage and stealage. An inspector is sent by the company to inspect the ties. This is generally a clerk from some of the offices, who frequently knows but little as regards the strength or durability of timber, and, as a consequence, some of the best ties are docked and only bring 20 cents apiece. The stealage is where the section men put in new ties which have not been inspected and received, and fail to report the use of the same to the roadmaster.

Most all cross-tie men also contract for bridge timbers and trestling, as well as telegraph poles. For the latter chestnut and cedar are mostly used. They bring about $1.75 apiece, and are cut mostly in the tamarac swamps of Michigan and the forests of Southern Kentucky and Tennessee. Large sums of money have been made by lucky contractors above

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described, and each only adds to increased demands. Ohio has over 4,000,000 acres wood land, yet the ever-increasing demand for railroad purposes alone, if supplied entirely from our forests, would leave us without a single stick to mark the existence of our once dense forests.—*Cincinnati Commercial.*

Adulterations of Carpet Yarns.

The use of cow hair, buffalo hair, camel's hair, and Russia cattle hair for the adulteration of wool is becoming a recognized business. It is claimed that these hairs are excellent substitutes for wool, and not only cheaper, but fully as durable.

We have records of its use at different eras in the world's industrial record, but as frequently as it has been employed so frequently has it been relegated again to the qualification of mattress and sofa stuffings. For some years, however, it has been employed by many carpet manufacturers to be worked into the yarns.

It is gathered in large quantities, and brought to this market for use in carpets at the rate of fully twenty million pounds per year. How much is made up in other fabrics we are unable to state. The hair is invariably taken from the hide at the tanner's, by means of a process termed "sweating," and is not clipped, as is the popular supposition. The hides are soaked in vats for from three to five days. They are then stretched on beams or stands, with arched surfaces, thus, ⌒, and then rubbed with a *sciver*, or scraper. The hair is easily susceptible to this proceeding, and peels off. It is next washed and baled. The hair is brought mostly from the West, though considerable "cattle hair" (called Russian cattle hair) comes from Europe. About four million pounds are imported to New York and Philadelphia annually, and used in the manufacture of blankets, cloakings, and carpets.

Buffalo hair is also used, though there is not so much coming into the market now as formerly, owing to the law having prohibited the slaughter of the animal for fear of the utter extermination of its breed. Two million pounds will cover the amount worked into carpets per annum. And again we find camel's hair used. We conversed with one dealer recently who assured us that he had sold over four hundred thousand pounds of the stuff during the past four months. This, like all such matter, is incorporated with other material—wool, shoddy, etc.—before spun into yarn.

Of the various hairs incorporated with wool textures, cow hair is the most common. When received in its rough state from the West, in bales, it is, *first*, washed; *second*, put through a picker, which eradicates all impurities; *third*, it is spread on an "apron," in quantities according to the intentions of the manufacturer, and the proportions of wool and shoddy are likewise selected and mixed with the hair; *fourth*, from the apron, the hair, shoddy, and wool are worked off (by a tender—usually a young girl—who mixes the selections) on to a carding machine, which mixes the properties evenly. It is then spun. The same process is applicable to all other kinds of hair.

The red cow hair is sold for about two and one-half to three and one-half cents per pound, and refuse light colorings; the *white* brings from eight to twelve cents per pound.

The Russia cattle hair costs more, the prices for which are: Russia cattle hair (red), four cents; Russia cattle hair (white), twelve cents. This hair, which was sent here at one time in no inconsiderable quantities, is now imported more cautiously. Much of the material was formerly lost in the refuse of the waste troughs and imperfected preparatory machines. Now, however, considerable economy is exercised in saving the wash and utilizing it. The prices brought to day, in the New York markets, for these "mixings" for *woolen* yarns, are as follows:

Cow hair (red), 2½ to 3½ cts.; cow hair (white), 8 to 12 cts.; buffalo hair, 8 to 12 cts.; camel's hair (Russian), 16 to 20 cts.; camel's hair (China), 22 to 28 cts.; camel's hair (noils), 40 cts.; Russia cattle hair (red), 4 cts.; Russia cattle hair (white), 12 cts.—*Carpet Trade Review.*

Tincture of Insect Powder.

A concentrated tincture of insect powder is highly recommended as an insecticide by Finzelberg, who prepares it by digesting one part of Persian insect powder in ten parts absolute alcohol, and claims that in order to prove efficacious it should be scattered by means of an ordinary perfumery atomizer. When thus used in closed rooms all flies soon drop dead; while scattering it over linen, etc., acts as a protection agains fleas, etc.

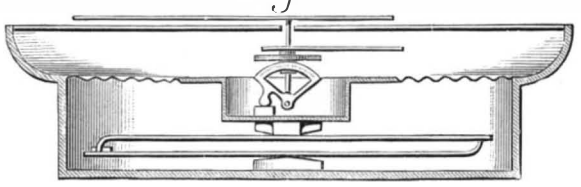
Azotine.

The *Annales Industrielles* notes a new discovery by M. Heddebault, which consists in the separation of wool from cotton in rags and waste products in which these two textiles are mixed, by treating them with steam at 150° C. under a pressure of five atmospheres. Under the influence of this temperature the wool is decomposed, fuses, and flows off into a lower receptacle, while the cotton, flax, and in fact all vegetable fiber, are unattacked. It is then only necessary to pound and wash the latter to obtain products containing no longer any traces of wool, and which are admirably adapted for bleaching and manufacturing into paper. The solution of wool, evaporated to dryness, has been named by the inventor *azotine*. Owing to the increase in value of mixed cotton and woolen rags thus treated, especially for paper making, the cost of the operation is virtually covered, and the new product—*azotine*—costs really nothing. This material, which is completely soluble in water, and which contains all its nitrogen in a soluble form, is to be used, mixed with dried blood, as a fertilizer. The invention is said to be an important one, both for the paper making industry and for agriculture.

THE FIRST INVENTOR OF THE STEAM GAUGE.

Mr. Sydney Smith, of Nottingham, England, who claims to be the "original inventor and first patentee of the steam pressure gauge," not long since sent a letter to the *Engineer* setting forth his claim, and giving a copy of a corroborative

Fig. 2



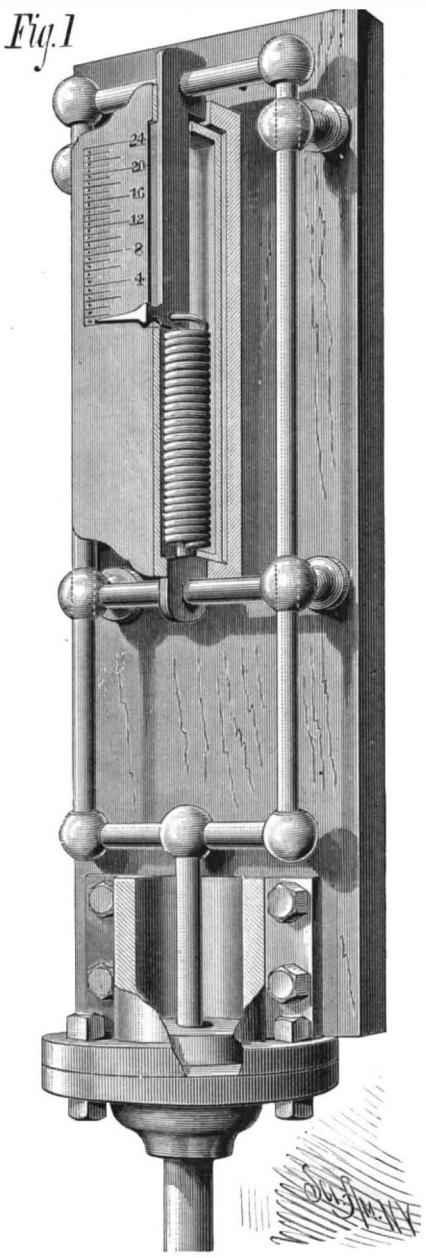
MOREAU'S STEAM GAUGE.

letter from George Stephenson. The following is the letter, together with a note appended by the editor of the *Engineer:*

"Tapton House,
"Chesterfield, October 15th, 1847.

"A most important invention has been submitted to me for my approval, patented by a Mr. Smith, of Nottingham, and intended to indicate the strength of steam in steam engine boilers. It is particularly adapted for steamboats, and can be placed in the cabin, on deck, or any other part of the vessel, where it may be seen by every passenger on board. It may also be fixed in the office of every manufactory where a steam engine is used at a considerable distance from the boiler. I am so much pleased with it that I have put one up at one of my own collieries. It is some distance from the boiler—in another house—and works most beautifully, showing the rise and fall of the steam in the most delicate manner. The indicator is like the face of a clock, with a pointer,

Fig. 1



BRADLEY'S STEAM GAUGE.

making one revolution in measuring from 1 lb. to 100 lb. upon the square inch of the pressure of steam. It is quite from under the control of the engineer, or any other person, so that its indications may be relied upon, and the construction is so simple that it is scarcely possible for it to get out of order. I might give a full explanation of the machine, but I think it best to leave that to the inventor himself. The numerous and appalling accidents which have occurred from the bursting of steamboat boilers have induced me to give you these observations, which I think desirable to be laid before the public. I may state that I have no pecuniary interest in the scheme, but being the first person to whom it has been shown, and the first person to make use of it, I feel it a duty I owe to the inventor, as well as the public, to make it as universally known as possible. The indicator is put up at Tapton Colliery, near Chesterfield, and may be seen any day by any respectable person.

(Signed) "GEORGE STEPHENSON."

"[We have taken some trouble to investigate Mr. Smith's claim to be considered the first inventor of a practical steam gauge, and we have every reason to believe that he is entitled to that honor. In other words, Mr. Sydney Smith, of Nottingham, patented, in 1847, the first steam gauge which was efficient, compact, portable, and suitable for use on boilers carrying a high pressure of steam. We have failed to find any record of an invention fulfilling the same objects of older date than Smith's patent.—ED. *E.*]"

We have been more fortunate than the editor of the *Engineer* in our search for the anticipator of this invention, in finding that two patents were granted in this country for practical steam gauges prior to 1847.

The first was granted to George Bradley, of Paterson, N. J., August 16, 1841. The second to De Fontaine Moreau, of London, England, August 20, 1846.

The construction of Bradley's steam gauge is so clearly shown in Fig. 1 as scarcely to require description. It consists of a cylinder connected with the boiler and containing a piston which is acted on by steam pressure, and connected with a rectangular sliding frame whose upward movement is opposed by a spiral spring. The sliding frame carries a pointer which moves over a fixed scale. Of this steam gauge the inventor, in his patent specification, says:

"The operation of the machine is thus: The steam pressing against the piston forces it outwards or towards the spring, and with it the rectangular frame, the cross-head of which, being connected with the fixed bar, causes the spring to which it is attached to become elongated, and the index which it carries to move opposite to that part of the scale which indicates the pressure against the piston. When the ordinary spring balance is used, if the area of the piston is one inch, the index will point on the scale to the number of pounds per square inch of pressure in the boiler above that of the atmosphere; the scale, however, admits of any mode of graduation.

"This machine is expected to become a necessary appendage to every steam boiler, for the purpose of enabling any one, however ignorant, to tell at any time by sight the pressure of steam in the boiler as well as the most experienced engineer.

"It is believed that there is now no instrument in use for this purpose. The ordinary spring balance which is usually attached to locomotive engines is connected to the lever of a safety valve, and merely indicates the pressure of the steam at the instant it is capable of lifting the valve and at no other time, and even then it requires a nice calculation to ascertain the pressure on the boiler, as it depends on the leverage of the safety bar, so that to an ordinary traveler it affords no information of the pressure of the steam by looking at it however minutely, while by the one now proposed, literally, 'he who runs may read,' and when we reflect on the number of lives that have been lost on board steamboats which such an instrument might have been the means of preventing, its value as a life-preserver will be apparent to all."

In Moreau's steam gauge, shown in the smaller engraving, the steam pressure acts on a diaphragm, whose motion is multiplied by a toothed quadrant and a pinion on the index arbor.

Nevada's Natural Phenomena.

Nevada is a land of curious natural phenomena. Her rivers have no visible outlet to the ocean. She has no lakes of any magnitude. She has vast stretches of alkali deserts, however, that give every indication of having been the beds or bottoms of either seas or lakes. Down in Lincoln county there is a spring of ice-cold water that bubbles up over a rock and disappears on the other side, and no one has been able to find where the water goes. At another point in the same county is a large spring, about twenty feet square, that is apparently only some eighteen or twenty inches in depth, with a sandy bottom. The sand can be plainly seen, but on looking closer it is perceived that this sand is in a perpetual state of unrest. No bottom has ever been found to this spring. It is said that a teamster, on reaching this spring one day, deceived by its apparent shallowness, concluded to soak one of his wagon wheels to cure the looseness of its tire. He therefore took it off and rolled it into the, as he thought, shallow water. He never laid his eyes on that wagon wheel again. Our mountains are full of caves and caverns, many of which have been explored to a great distance. Speaking of caves, a redeo was held last spring over in Huntington valley. During its progress quite a number of cattle were missed and for a time unavailing search was made for them. At last they were traced to the mouth of a natural tunnel or cave in the mountain. The herders entered the cave, and following it for a long distance, at last found the cattle. It appears that they had probably entered the cave, which was very narrow, in search of water. It had finally narrowed so that they could proceed no further. Neither could they turn around to get out. They had been missed some days, and if they had not been found must inevitably have perished in a short time. As it was they were extracted from their predicament with difficulty, by the herders squeezing past and getting in front of them and scaring them into a retrograde movement by flapping their hats into the faces of the stupid bovines.—*Eureka Leader.*

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Another New Atlantic Cable.

When the excitement in this country and Europe which attended the laying of the first Atlantic cable, and the doubt, delays, and misfortunes of that great enterprise, are contrasted with similar operations at the present time, we are enabled to realize the progress which has been made in telegraphy within less than a quarter of a century. The Anglo-American Telegraph Company has just completed the work of laying a new cable from Valentia to Heart's Content, and so much a matter of course has it become, and so certain and comparatively easy an operation, that it attracts scarcely any public attention. The newspapers record the fact in a news paragraph of a dozen lines, and scarcely an allusion is made to it in editorial columns.

These slender cords buried in the depth of the sea now connect every country of the earth, and the history of the preceding day at the Antipodes appears in the morning papers as regularly as the incidents occurring in the immediate vicinity of their publication. The electric telegraph has bound together the most widely separated sections of the earth, and has revolutionized the business and social systems of the world.

The Atlantic cable telegraph business has developed so enormously and is so rapidly and constantly increasing as to continually demand additional facilities, and these the Anglo-American Company promptly furnish. A few years ago one cable more than sufficed for all the business offered. The business was then an experiment, and the necessarily high rates charged for the service restricted the patronage to very limited proportions. From time to time, as experience enabled it to be done with safety, these charges have been reduced until, at the present time, messages are transmitted between this country and Europe at rates which would have speedily ruined any company a few years ago. It is true that the charges for cable telegraph service across the Atlantic are at present abnormally low (12½ cents per word) in consequence of bitter competition of rival companies, but even without such competition the service will hereafter be profitably performed at a cost to the public which, not many years since, would have been regarded as absurd and ridiculous to propose. This is made possible by improvements in the construction and operation of the cables. By duplexing the cables their capacity for the transmission of business has been practically doubled, and it is not regarded as impossible that their capacity may yet be still further largely developed.

The Anglo-American Company has now in operation four cables, and the Direct United States one, which by the successful application of the duplex system in working them afford facilities equal to what would have been realized with ten worked in the ordinary way. It is expected that these will adequately meet the demands of the public for some time to come. Should more be required, however, the managers of the Anglo-American and Direct Companies are prepared to supply them promptly, each company having wisely accumulated a large reserve fund for maintenance of existing cables, and providing new ones as required.

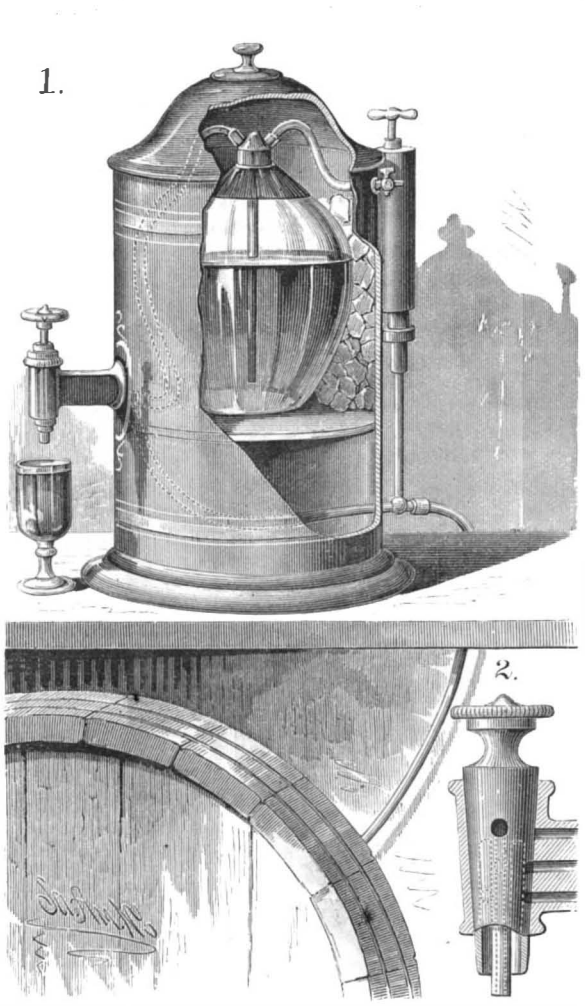
The efforts of the cable companies are liberally seconded by the Western Union Company, which is now engaged in building an entirely new line of the largest wire used for telegraphic purposes, which is to be quadruplexed and used exclusively for cable business.—*Journal of the Telegraph.*

A Chemical Lung.

On Wednesday, August 18, Dr. Richard Neale, in the presence of a number of engineers, including the manager of the underground railway, and other scientific men, gave an interesting and, as far as it went, successful demonstration of a scheme to purify the foul air of tunnels, mines, cabins, churches, theaters, hospitals, and other buildings. The proposal is, we believe, a novel one, and promises to create a new era in ventilation. Nearly all attempts hitherto made to purify the air in crowded buildings have been mechanical, and have consisted of driving out the foul air by currents of fresh air. Dr. Neale's proposal, on the other hand, is a chemical one, and is designed to destroy the poisonous gases. It is not, of course, intended to supersede ordinary ventilation by currents, but rather to act as an auxiliary. The essence of the scheme is the adoption of some simple chemical facts. As the lungs of living beings appropriate oxygen and give off carbonic acid gas, Dr. Neale proposes to make a "chemical lung" which will appropriate carbonic acid and sulphurous gases from the air containing them, without yielding any products in exchange. The air in the tunnels of the underground railway was referred to as a conspicuous and well known example of impurity irremediable by mechanical means. The principal deleterious gases in this instance are carbonic acid and sulphurous gases and carbonic oxide. All these, but especially the two former, may, Dr. Neale maintains, be easily got rid of by chemical means. By mixing a solution of sulphurous acid and water in a flask Dr. Neale made an excellent imitation of the air at the Baker street or Portland road station. He then added a small quantity of solution of caustic soda, and agitated the flask briskly for a few seconds, and immediately the sulphurous smell was abolished. Into the same flask a current of carbonic acid gas was next passed, so that a lighted taper introduced into the flask was at once extinguished. After a few shakings a lighted taper was again introduced and burnt with a bright, steady flame, showing that the soda had taken up the acid. Similar experiments were made with solutions of caustic lime. Dr. Neale said the facts illustrated in these simple experiments formed the basis of his scheme for purifying ordinarily impure air. As regards the Metropolitan and other underground railways, the locomotive engines might, he said, be supplied with a tank containing a strong solution of caustic soda or lime, through which the smoke should be made to pass before being discharged into the outer air. By this means the carbonic acid gas and the sulphur would be eliminated. The carbonic oxide would require to be dealt with in another way, which need not now be explained. In order to attain further purification of the air in the tunnel, each train might be furnished with a truck open at both ends, and appropriately fitted with trays or other contrivances for holding solutions of lime or soda. As the train progressed air would rush through the tanks or trays, and be robbed of its carbonic acid and sulphur in its course. The proposal is as happy as it is ingenious. It further commends itself on the grounds of simplicity and cheapness. It only remains for those concerned, and we would especially indicate the directors of the underground railway and the managers of theaters, to manifest a proper public spirit, and fairly test its practicability. There should be no insuperable difficulty in putting it to a practical test. Meanwhile, we shall watch with interest any attempts that may be made to carry out the idea in detail.—*London Lancet.*

NEW BEER FAUCET.

Beer making and selling have attained an importance both in extent and pecuniary interest all over the world that ranks it among the greatest industries of the age. Malt



NEW BEER FAUCET.

liquors constitute the beverage of the multitude, and it is essential that these liquors be dealt out in a sweet and wholesome condition. All kinds of malt liquors that are beginning to sour, or have become sharp pricked or stale, are unwholesome, since these terms express the several stages through which all malt liquors pass by exposure to the atmosphere, from a palatable article to that of an offensive and dangerous one; hence various and often expensive devices have been resorted to, both to force beer from a cask without permitting its gas to escape, and to bring it from below up to a counter, none of which have hitherto answered a satisfactory purpose.

The improved beer faucet shown in the engraving is secured by three United States patents, and is patented in England, France, and Germany. Beer and other malt liquors, to be wholesome and properly preserved, must either contain or be capable of generating an amount of gas sufficient to empty the cask by its expansive force. Proceeding upon this proposition, which was found by numerous trials to be correct, it seemed manifest that to preserve such liquor from becoming stale and unwholesome it was only necessary to prevent the air from entering the cask and the gas from escaping from it, and apparatus, by which a glass of beer can be readily drawn from a fresh keg without waiting for the excess of froth to subside, is desirable.

The patentees of the faucet illustrated claim that they have succeeded in making such an apparatus, which, if adopted, would afford a great pecuniary benefit to the brewer in saving great numbers of long brass faucets, short and less expensive ones being as good, and largely avoiding the liability of empty beer kegs becoming sour and musty by exposure to the air before they are refilled; and it will secure to the retailer a great saving of time, and also the labor attendant upon the insertion and removal of vent valves, to say nothing of the great waste from the beer becoming stale.

This device may be either cheap or ornamental, and it is capable of preventing beer from becoming stale at any age, and it will bring beer that is fit to drink from the cellar without the use of a pump. It will also cool it without extra expense, since the ice that is used to cool drinking water also cools the beer. It can be readily applied to any faucet in a cask by means of a hose and coupling.

The engraving shows a sealed beer receptacle placed in the ice chamber of an ordinary water cooler. The faucet of the cooler, however, performs three separate functions: it will draw ice water from the cooler, it will take beer directly from the cask, or from the glass receptacle, as may be desired. The internal construction of the faucet is shown in Fig. 2. A model of this apparatus is on exhibition at the Inventors' Institute, No. 733 Broadway, New York.

Further information may be obtained by addressing Dr. A. J. Spencer, No. 115 W. 126th street, New York, or the Inventors' Institute as above.

THE AMERICAN SCIENCE ASSOCIATION.

The proceedings of the first two days of the Boston meeting of the American Association for the Advancement of Science were noticed last week. The early promise of a large and, in the fullest sense of the word, popular meeting was amply fulfilled. Nearly a thousand members were registered; 595 new members and 45 fellows were elected, among them Mrs. E. A. Smith, of Jersey City, the first lady thus honored. The number of papers entered was 280. A very active interest was manifested in the proceedings throughout, and the hospitality of the people of Boston and the surrounding towns was unbounded. Boston and its vicinity are rich in institutions, manufactories, pleasure resorts, and points of historic interest, and not a few of the members found these sources of pleasure and profit unsurpassed even by the regular proceedings of the association.

Comparatively few papers were read before the general sessions, the attendance being so large and the number of papers so great that most of the work was done in the sections and subsections. In view of the increasing size of the annual gatherings the committee on membership reported in favor of extending the scope of the association, recommending that instead of two sections with subsections, as at present, the association should have eight, as follows:

A—Physics. B—Astronomy and Pure Mathematics. C—Chemistry, including its applications to agriculture and the arts. D—Mechanical Science. E—Geology and Geography. F—Biology. G—Anthropology. H—Economic Science and Statistics. It was also recommended that there may be a permanent subsection of microscopy, which shall elect its own officers, and be responsible directly to the Standing Committee, and that the Sectional Committee of any section may, at its pleasure, form one or more temporary subsections, and may designate the officer thereof. The report will be acted upon at the next meeting.

Among the other reports of special committees two were of general interest. The report of the Committee on Science-teaching in the Public Schools has been noticed elsewhere. The committee to memorialize Congress and State legislatures regarding the cultivation of timber and the preservation of forests recommended a law to protect trees planted along highways, and to encourage such planting by deductions from highway taxes; also the passage of a law that shall exempt from taxation the increased value of land arising from the planting of trees where none were growing to such period as may appear proper, or until some profit may be realized from plantations; by appropriations of money to agricultural and horticultural societies, to be applied as premiums for tree-planting, and for prizes for the best essays and reports upon subjects of practical forest culture; by encouraging educational institutions to introduce courses of instruction having reference to practical sylviculture; by laws tending to prevent forest fires; by imposing penalties against willful or careless setting of such fires, and enlarging and defining the powers of local officers in calling for assistance and in adopting measures for suppressing them; by establishing under favorable circumstances model plantations; by the appointment of a Commission of Forestry under State authority analogous to the Commission of Fisheries.

The cable message to the British Association, previously referred to, received a cordial answer returning thanks therefor. A message of congratulation was also sent to the venerable M. de Chevreul, senior member of the French Academy, on his 95th birthday.

The officers elected for the next meeting, in Cincinnati, to begin August 17, 1881, are: President, Professor G. J. Brush, of New Haven; Secretary, Professor C. V. Riley, of Washington; Treasurer, Professor W. S. Vaux, of Philadelphia; President of Section A, Professor A. M. Mayer, of Hoboken; Secretary, Professor John Trowbridge, of Cambridge; Vice-President of Section B, Dr. George Englemann, of St. Louis; Secretary, Professor William Saunders, of Canada; Auditing Committee, Professor Henry Wheatland, of Salem, and Professor Thomas Meehan, of Philadelphia.

In the permanent subsection of Chemistry, Professor William Ripley Nichols, of Boston, was elected Vice-President, and Professor H. W. Wiley, of Lafayette, Ind., Secretary. In the permanent subsection of Anthropology, Colonel Derrick Mallory, of Washington, was elected Vice-President,

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and Judge J. G. Henderson, of Winchester, Ill., Secretary. A resolution providing for a social reunion of the sections on the second evening of future meetings was adopted.

As already remarked, the most of the papers were read in the several sections and subsections. It would not be possible within the scope of this article even to mention them all by title. A few of those of most general interest may be noticed. In Section A (Physics) Professor A. M. Mayer described the construction and use of the topophone, with which our readers are already familiar. Professor A. Graham Bell presented his new invention, the photophone, the nature and use of which was described last week. Mr. A. P. Dudley, of this city, read a practical paper on "Transportation Expenses and their Reduction," and gave the results obtained by his invention, the dynograph, designed to test questions in regard to the economical handling of railway trains. This instrument shows that on ordinary roads it is more economical in fuel to run freight trains from eighteen to twenty miles per hour than at ten or twelve. It shows the largest types of engines to be most economical, hauling greater loads per pound of coal, reducing the ratio of train expenses per ton carried. Also, that the dead weight per car, per ton capacity of freight, should be reduced to the lowest limit consistent with safety, as it costs proportionately more to haul empty cars than loaded ones.

Mr. Wm. H. Ballou, of Chicago, read a paper on the "Mississippi River Improvement System." A hint of the magnitude of the problems involved was given in the shifting of the course of the Mississippi at Cairo, Ill., a mile in one year. Still more remarkable than this are the operations of the Missouri River. At one time Council Bluffs enjoyed its presence in immediate proximity to the city and the benefits of its commerce, in consequence of which the city became the terminus for the Western railways in preference to Omaha, three times its size. These railroads erected depots and stationed the offices of the general Western superintendents here. The Union Pacific road constructed an immense bridge here, and in common with other railways built a union depot at Council Bluffs. No sooner had this work been completed than the Missouri performed the unexpected feat of moving its channel over to Omaha, three miles away.

Mr. E. B. Elliott, of Washington, read a paper on "Electric Lighting as applied to Large Areas;" Mr. C. J. H. Woodbury one on "Friction and Lubricating Oils;" Professor B. F. Hedrick, of Washington, on "Patent Laws as a Means for the Advancement of Science." Of scientific papers less obviously bearing upon practical affairs the number was large—too large for their reviewing here.

In the subsection of Chemistry a valuable paper on "Laws Governing the Decomposition of Equivalent Solutions of Iodides under the Influence of Actinism" was submitted by Professor A. L. Leeds, of the Stevens Institute. Professor A. A. Breneman, of Cornell University, exhibited samples of common stoneware, hitherto decorated only in blue, on which he has been able to obtain a wide range of colors. On one specimen vase a vine in green was painted upon the ordinary gray body of stoneware. This cheap ware may in this way be made the basis of a new process of underglaze decoration in which the entire piece—color, glaze, and body—is completed at a single burning. The theory of the new process rests upon the thickness and comparative impressibility of the glaze. A note on "Water Analysis" was read by the same gentleman.

Mr. H. W. Wiley, of Lafayette, Ind., read a practical paper on the "Manufacture of Glucose." Professor S. B. Sharples showed a method of testing sugar and molasses; Mr. E. T. Cox discussed the "Oxide of Antimony found in Extensive Lodes in Sonora, Mexico;" J. C. Kleinschmidt read a paper on "Foreign Substances in Iron;" and Professor T. Sterry Hunt one on the "Genesis of Certain Iron Ores."

Section B (Natural History) gave evidence of great activity in this field of science. The subject of "Biological Development in the Animal Kingdom, as Manifested in the Paleontological and Embryological Study of Sea Urchins," was illustrated at great length by Professor Alexander Agassiz; and Professor A. Hyatt found a practical illustration of the "Theory of Evolution in the Transformation of the Planorbis." Incomplete adaptation, as illustrated by the "History of Sex in Plants," was treated by Mr. L. F. Ward; and the "Evolution of Parasitic Plants," by Mr. Thomas Meehan. Dr. S. V. Clevinger submitted a less popular communication on the "Plan of the Cerebro-spinal Nervous System." The "Economic Aspects of Natural History" were touched upon by Professor T. J. Burrill, of the Illinois Industrial University, in a paper on the microscopic cause of "fire blight" in pear trees and "twig blight" in apple trees. Also by Professor Riley in a paper on the "Cotton Worm;" and by Mr. A. J. Cook, who described two new methods of fighting injurious insects. The papers in the subsection of Microscopy were chiefly such as were of interest solely to the specialists of that department.

The papers in the subsection of Anthropology were many and rich in curious information. The "Ethnology of Africa" was discussed by Professor A. S. Bickman. The Myths, Folklore, Language, and Games of the Iroquois Indians, were learnedly discussed by the only lady fellow, Mrs. E. A. Smith. Colonel H. B. Carrington read an interesting paper on the "Dakota Tribes." Judge Henderson described the textile fabrics of the ancient inhabitants of the Mississippi Valley. In explaining the textile art among the mound-builders and other ancient American aborigines, he showed that the modern Indians and these ancient people are bound together by a similarity in instruments and processes of spinning and weaving. The material used was the bush of various trees, nettle, and the hair of the bear, buffalo, deer, and dog. In working up vegetable substances, the bark was first macerated, and, after being dried, it was spun in a multitude of ways. The rudest process was rolling on the thigh. The next improvement was a rude spindle, which passed through various processes of evolution to the modern spinning wheel. The gradations of elaboration through which the loom has passed were illustrated by a series of drawings, collections of raw materials, and models of spindles and looms.

Mr. William McAdams described the agricultural implements of stone anciently employed by the natives of the same region, and Mr. F. W. Putnam spoke of the conventional ornamentation of ancient American pottery. In a paper on ancient quarries of Oriental alabaster and flint in the West, Rev. H. C. Hovey described and illustrated by maps, diagrams, and specimens, some remarkable discoveries made by him in Wyandotte Cave, Indiana. Professor E. S. Morse gave an instructive account of his investigations among the shell heaps and caverns of Japan.

In the subsection of Geology Mr. N. H. Winchel read a paper on "Capriferous Series in Minnesota," and Alexis A. Julien gave a description of the excavation of the upper basin and clove of the Kaaterskill (Catskill) Mountains. L. W. Bailey reported the progress of the geological investigations in New Brunswick in 1879 and 1880, and was followed by H. C. Lewis, upon the "Tertiary Age of Iron Ores of the Lower Silurian Limestone Valleys." Professor Silliman spoke upon the turquoise localities of Las Cenillos. Other contributions to this subsection were: "Granites in the White Mountain Notch upon Mount Willard and their Contact Phenomena," by George W. Hawes; "Eruptive Rocks of Mount Ascutney," by Professor C. H. Hitchcock; "Coals of Galisteo, New Mexico," by Professor B. Silliman; and "Auriferous Gravels of the Upper Rio Grande in New Mexico," by the same.

Sugar Making in Louisiana.

At a recent meeting of the Sugar Planters' Association in New Orleans, the following paper was read by Mr. Mason:

"During the last decade there has been an anxious inquiry from planters and others interested in sugar culture as to the possibility of a more complete and thorough extraction of the saccharine contained in the cane without the attendant injuries that previously followed all former efforts wherein 'inversion' proved so serious an obstacle, and which cast a doubt on extreme extractions ever being rendered profitable to the planters' interests. In Mr. Bouchereau's report of 1870–71, Mr. Edw. D. Seghers queries: 'Whether or not it would pay to throw away our sugar rollers and adopt the system of drawing the juice by the action of hot water, as patented lately in Germany?' Whether this was the first keynote on diffusion, I do not know. I merely mention this item. In 1872–73, Mr. M. S. Bringier, with Dr. J. Albrecht, made experiments on that principle. The 'Mason saturator' was also experimented with this year.

"In 1873–74 Mr. Bringier and Dr. J. Albrecht tried again with a different machine, also the Robert diffusion, at Belle Alliance, and the Mason saturator at the Beka. In 1874–75 Mr. Bringier and Dr. J. Albrecht used another different machine. The Robert diffusion was again used and the Lovejoy-Luling apparatus for diffusion. In 1875–76 the Robert diffusion was inaugurated at the Louisa, and it was said that splendid results were obtained. The Mason saturator was removed to Mr. Spangenberg's, at La Freniere, and Mr. Von Phul reintroduced the Payen jets of steam through the turn plate to the partly crushed cane. In 1876–77 the Robert diffusion, the Mason saturator, the Von Phul, also a nine roller mill of Mr. Bringier and Dr. J. Albrecht, were worked at the Corrinne. In 1878–79 the Robert diffusion, the Mason saturator, and the Von Phul were used.

"In 1879–80 Mr. Bringier, with Dr. J. Albrecht, tested the eleven roller mill at Mr. Godberry's. The Mason saturator and the Von Phul were also used. The Robert diffusion of 1873 produced a yield of molasses of 180 per cent to every 100 barrels of sugar. In 1874 the molasses showed 85 per cent, while in 1875 it was reduced to 61 per cent. The yield of the Mason saturator in 1876–77, according to the *Price Current* yearly report, was 37·5 per cent of molasses. In order to compare this, I have taken the returns of nine prominent plantations, taking the Spangenberg place as the center, so that they shall then range equally as to ripeness of the canes, action of frost and temperature, they all having superior means of evaporation over the evaporators used there, without taking into consideration the excessive strain used on the three roller mill causing its detention for repairs, the souring of its sirups, and the other difficulties encountered by the use of a vacuum from where kettles were used before.

"Grinding commenced in November and was completed in or about the third week of January. This average of the nine plantations amounted to 54·3 per cent, showing 16·8 per cent in favor of the Mason saturator. In 1877–78, that disastrous year to planters, the percentage stood for the Mason saturator at 57, while the nine plantations stood at an average of 113 per cent. The immature canes of this year would, if 'inversion' was the characteristic of the 'saturator,' certainly have condemned its future use. But from this date a change of yield appears: emasculation and interference have somewhat changed its features.

"The yield of Mr. Wilkinson's five roller mill, with his triple effet, stands at 41 per cent, while Mr. Geo. Garr's, with Rillieux apparatus (triple effet), stands at but 30 per cent of molasses to the sugar. I also find that the Howard and Morris mills at the Ashton plantation show a percentage of 42 to the yield of sugar. The yields of juice at the Yale Mill are 64·27; Mr. Wilkinson's, 72·70; and Mr. Godberry's, 68·86.

"I will now state the yield of molasses to the sugar, according to Mr. Bouchereau's report, during the last decade, as follows, as it will tend to show in a measure the maturity of the cane, also the progress made in the introduction of the vacuum pan into the sugar house: In 1870–71 crop, 70 per cent of molasses and 53 vacuum pans. In 1871–72 crop, 86 per cent of molasses, 58 vacuum pans. In 1872–73 crop, 81 per cent molasses, 56 vacuum pans. In 1873–74 crop, 91 per cent molasses, 55 vacuum pans. In 1874–75 crop, 94 per cent molasses, 52 vacuum pans. In 1875–76 crop, 76 per cent molasses, 57 vacuum pans. In 1876–77 crop, 73 per cent molasses, 65 vacuum pans. In 1877–78 crop, 111 per cent molasses, 64 vacuum pans. In 1878–79 crop, 64 per cent molasses, 86 vacuum pans. In 1879–80 crop, 71 per cent molasses, 108 vacuum pans. The yearly average of molasses to sugar, for the decade, being 81·7 per cent. Considerable increase in vacuum pans commenced in 1876, amounting at present to 108, showing an addition of 51. It must be also borne in mind that during this time many old Rillieux pans have been broken up. By information kindly rendered, I find that Messrs. Shakespeare & Smith are erecting for this coming crop a vacuum pan for Mr. Ware, Iberville, and one for Mr. Von Phul, East Baton Rouge; and Messrs. Leeds & Co. are manufacturing them for a number of planters—an addition of 10 vacuum pans for this coming crop of 1880–81, which will give a total of 118 vacuum pans to our State. I did not think it necessary to note each year other evaporators, but it may be as well to state that in 1870 there were 868 kettles, 95 open pans, and 11 Escudier evaporators; 1,105 sugar-houses were in operation, of which 837 were steam and 268 horse power. In 1880 there are 816 kettles, 122 open pans, and 11 Escudier evaporators in 1,111 sugar-houses, of which 837 are steam and 274 horse power, a difference of 6 horse power sugar-houses. In 1870 there were 78 portable mills; in 1879 there were 54 portable mills.

"In the special mention of the Howard and Morris mill by the *Price Current* report, it says, in speaking of the second experiment, there were 181,789 pounds of sugar, and the estimate of the molasses was 46 gallons to 1,000 pounds sugar, 53 per cent, while the general yield of the crop in the column shows but 42 per cent. The Canal Bank having purchased the 'La Freniere,' arrangements have been made to run the Mason saturator this season, so that no doubt may exist. The Roberts diffusion apparatus is being broken up. As to the fate of the others, I have no information."

ENGINEERING INVENTIONS.

Mr. Christian W. Hergenroder, of Baltimore, Md., has patented a surveying and plotting instrument whereby a given route or boundary may be rapidly surveyed and plotted mechanically. In the old mode of surveying on foot only about four miles per day can be accomplished, by reason of the necessarily slow progress which the details of this method permit. This invention contemplates measuring and recording distances, with the curves, and also the elevations and declinations, with as great rapidity as the route can be traversed in an ordinary wheeled vehicle.

Mr. William L. Fisher, of South Saginaw, Mich., has patented an improvement in that general form in which a dog or tumbler holds up a shouldered pin until the dog is struck by the entering link, at which time the dog is removed from the shoulder of the pin and the latter falls of its own weight through the link to effect the coupling of the cars. The invention consists in so constructing the shouldered pin and the dog, and relatively arranging these parts in the draw head, that the shoulder on the pin not only affords a bearing for the dog in holding up the pin, but also, when the pin is down, serves as bearing, which rests directly upon the rounded end of the link and holds the latter in horizontal position while coupling with another drawhead.

Messrs. Alexander K. Suddoth and William L. Canfield, of Friar's Point, Miss., has patented a simple and efficient device for loading wagons, storing goods in warehouses, etc. It consists in the combination of a windlass and a car or carriage with ordinary skids.

An improved apparatus for compressing air has been patented by Mr. Robert M. Catlin, of Tuscarora, Nev. This invention is primarily an improvement in apparatus for elevating water by the direct action of compressed air, such as shown in letters patent granted to the same inventor, No. 231,778, November 18, 1879, but contains features that are applicable in connection with any steam or air engine.

Mr. William Freienmuth, of Lawrence, Kan., has patented a millstone and spindle adjusting device, that will enable the miller to detect at any time if the lower stone is out of level or if the spindle is not at right angles with the grinding surface of the stone, and enable him also to adjust both lower stone and spindle correctly while at work.

HON. W. D. BISHOP, formerly Commissioner of Patents, and more recently President of the New York and New Haven Railroad, has a carriage mounted on bicycle wheels with India-rubber tires. The wheels were made by the Pope Bicycle Manufacturing Company, and are of steel, nickel plated.

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IMPROVEMENT IN BILLIARD TABLES.

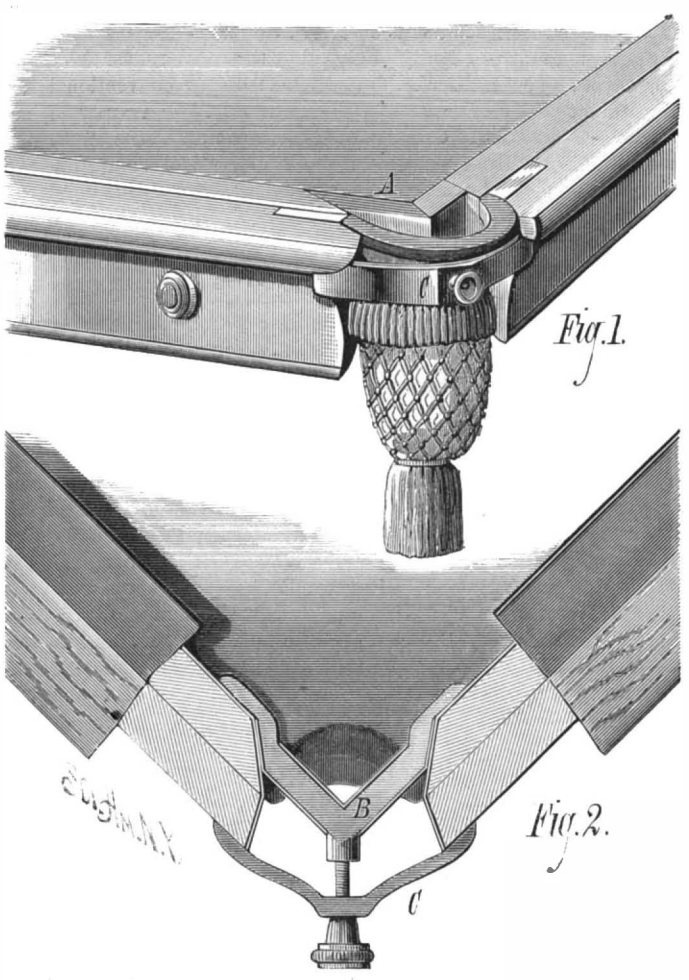
Attempts have been made to apply supplementary sections of cushion to pocket billiard tables for the purpose of transforming them into carom tables, but these efforts have failed because the manner in which the supplementary sections were applied tended to deflect portions of the main cushion or of the supplemental cushion from a true line, and thus interfere with the proper working of the table.

The engraving shows a novel and effective method of securing the supplemental cushion in place without distorting the faces of the cushions. The removable cushion piece, A, is of the usual form, and is fitted so as to fill the gap between the end and side cushion and render the arrangement of the cushions virtually the same as if the main cushions were mitered at the corner of the bed. The supplemental cushion, A, is attached to an angled casting, B (Fig. 2), and is drawn to its place by a screw passing through a yoke, C, which bears against the outer side of the cushion rails.

The side pockets are closed by a straight section of cushion, drawn to its place by a screw passing through a straight yoke.

The advantages of this invention will be readily recognized by those familiar with the requirements.

This device was recently patented by Mr. John Walsh, and is being manufactured and introduced by The H. W. Collender Co., 788 Broadway, New York city.



WALSH'S IMPROVEMENT IN BILLIARD TABLES.

A Powerful Eight-inch Gun.

The *Army and Navy Register* says: "Gen. Stephen W. Benet, Chief of Ordnance, U. S. A., during his visit to Sandy Hook, last week, ordered a continuance of the experimental tests of the eight-inch chambered rifle with which such excellent results have recently been obtained. The gun has already been fired some thirty-five times, but General Benet desires to have it tested still further, and if it sustains the strain of 100 rounds its value will be shown to be very great. These eight-inch guns which were fired with only thirty-five pounds of powder before they were chambered now take a charge of fifty-five pounds, and are capable of penetrating ten inches of iron at a distance of 1,000 yards. These results are very remarkable, when it is considered that the old ten-inch smooth bores, which were converted into eight-inch rifles, were fired with a charge of only sixteen pounds of powder, and with a shot weighing only 120 pounds, while the converted gun takes a charge of fifty-five pounds and a shot which weighs 180 lb."

DOUBLE TREADLE ATTACHMENT.

In running sewing machines and other light machinery in which foot power is used intermittently, a great deal of effort is expended in stopping and starting the machine, and the trouble increases with the increase of size and weight of the moving parts, so that it has been impossible to take advantage of heavy flywheels and a continuous motion. The engraving shows a treadle attachment invented by Mr. D. S. Van Wyck, of Fishkill Plains, N. Y., and recently patented in this country, in Canada, England, France, and Germany. It will be seen that the treadle levers are very long, and the stool upon which the operator sits is inclined so that the greater portion of the weight of the body is on the treadles, and the latter being long the greater portion of the weight is thrown directly upon the eccentrics on the driving shaft of the machine. The treadles are worked with the legs in alternation, the entire muscular force of the leg being available instead of the muscles of the foot and ankles merely as in ordinary treadle mechanism. In this device a heavy fly wheel is employed, and the belt runs over a pulley on the sewing machine, and a tightener and brake which are operated by the knee are used to stop and start the machine, the hands being left free to be applied to the work. The large flywheel is rotated continuously, and the machine head may be stopped and started without making any noticeable difference in the motion of the balance wheel and treadles, thus saving a great deal of labor generally expended in starting and stopping. The movement is similar to that of walking, the weight of the body being transferred from one foot to another, and the exertion is healthful rather than hurtful.

The usual heavy balance wheel on the machine head is replaced by a small pulley, which can be easily stopped and started while the heavy driving wheel continues to rotate, affording an equable motion, and economizing the power applied. The machine is manufactured in Poughkeepsie, N. Y., and will be exhibited at the coming New York State Fair and at the American Institute Fair.

For further particulars address the patentee as above.

Iridescent Glass.

One of the principal manufacturers of iridescent glass is M. L. Clémanpot, who invented and patented the process of producing iridescent effects on glass by the reaction upon it of divers chemical agents under pressure and at a high temperature. Under the name of glass, M. Clémanpot includes all substances resulting from the fusion of silica, which acts as an acid with bases, such as potash, soda, lime, oxide of lead, and the like. In submitting one of these compounds —*e. g.*, glass with a base of potash, soda, lime, or lead—to the action of the different acids, and under a pressure of from thirty to seventy pounds per square inch, iridescent, nacreous, or similar effects, resulting from the decomposition of the glass, are obtained. If among other reactions, under a pressure of from thirty to seventy pounds, water acidulated with hydrochloric acid in the proportion of fifteen per cent of acid is employed, nacreous and iridescent effects resembling those of ordinary mother-of-pearl, or nacre, are obtained. It is said that the same effect can be produced without pressure. The applications of this process are numerous, and include the production of nacre, the manufacture of pearls and opals, imitations of antique glass, and similar work.

VAN WYCK'S TREADLE ATTACHMENT FOR SEWING MACHINES.

MISCELLANEOUS INVENTIONS.

A safety cylinder cock for steam engines that will act automatically to discharge water that may be in the cylinder at any time, and thus avoid the danger arising from the presence of such water, has been patented by Mr. Thomas L. Smith, of Ames, Iowa.

An improved windmill has been patented by Mr. Lewis C. Ashley, of Detroit, Mich. The object of this invention is to furnish windmills simple in construction, inexpensive in manufacture, and not liable to get out of order.

Messrs. Leopold Michel and Charles Schirrmeister, of Brooklyn, E. D., N. Y., have patented an ash box to be placed upon the sidewalk at tenement houses and in other places to receive ashes and garbage. It is so constructed that the ashes may be conveniently sifted as they are being put into the boxes, and the ashes and garbage can be readily shoveled out. The device may be used for coal boxes and for other purposes.

An improvement in book-binding has been patented by Mr. James W. Loveridge, of Jersey City, N. J. The object of this invention is to lighten the expense and labor of binding books by enabling the binder to stamp, gild, or print the covers and back at one operation. It consists in forming a book cover in one piece of a material of uniform thickness to allow the covers and back to be stamped, gilded, or printed at one operation, and grooving the inner side of the back to give flexibility to the back of the book.

An improved apparatus for producing copies of writings has been patented by Mr. Aaron J. Underhill, of Appleton, Wis. The object of this invention is to provide means for producing facsimile copies of writings, drawings, or delineations in a more simple, inexpensive, and expeditious manner than has heretofore been done.

Mr. Theophilus Larouche, of Williamstown, N. Y., has patented an improved thill coupling. This invention consists in a novel construction and form of the pivot of the thill iron, and the combination therewith of a set screw working in the socket of the clip.

Mr. Gustavus O. Goessling, of Jersey City, N. J., has patented an improved dish or plate which is divided into several compartments for the different kinds of food, and with an improved rim to prevent the plates from tipping when several are placed on top of each other.

Mr. Charles W. Allen, of Pine Ridge Agency, Dakota Ter., has patented a hay rake and buncher, so constructed that the hay may be dumped by the advance of the machine.

Mr. William G. Patton, of Park's Station, Tenn., has patented an improved rotary cotton chopper, of which nearly all the parts can be readily constructed, repaired, and replaced by an ordinary blacksmith.

An improved stalk cutter, patented by Mr. Brainerd W. Smith, of Nineveh, Ind., is so constructed as to lay the stalks in proper position and cut them with certainty. The invention consists in combination of devices that cannot be clearly described without engravings.

Mr. Carl W. Stauss, of Coltbus, Prussia, Germany, has patented an improved reed ceiling which is very light and durable. The invention consists in a ceiling formed of two adjoining layers of coarse and fine netting, made of longitudinal reeds and transverse wires attached to strips nailed to the under side of the floor beams and covered with plaster.

Mr. Josias R. King, of St. Paul, Minn., has patented a calendar, which he calls the "Economical Advertising Calendar." Its cost is small compared with those now in ordinary use. It will furnish all information usually contained in calendars, and the information is presented to the eye in a new and compact form.

An apparatus for piercing ears for earrings, so constructed as to facilitate the operation, lessen the pain, and allow the hole to be made in exactly the desired spot, has been patented by Mr. Martin Haller, of Ann Arbor, Mich.

Mr. Denis Minogue, of Chicago, Ill., has patented a snap hook in which the ring can be readily engaged and from which it can be as readily disengaged when desired, but not accidentally.

Mr. Edward B. Carter, of Huntsville, Ala., has invented a device for lifting dead bodies and placing them in the coffin. It consists of two standards having vertically adjustable rods that support a horizontal beam, from which depend straps that may be looped about the body, so that the body may be lifted and moved by persons taking hold of the ends of the beam and raising the beam from off the vertical rods.

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SEALS.

BY A. W. ROBERTS.

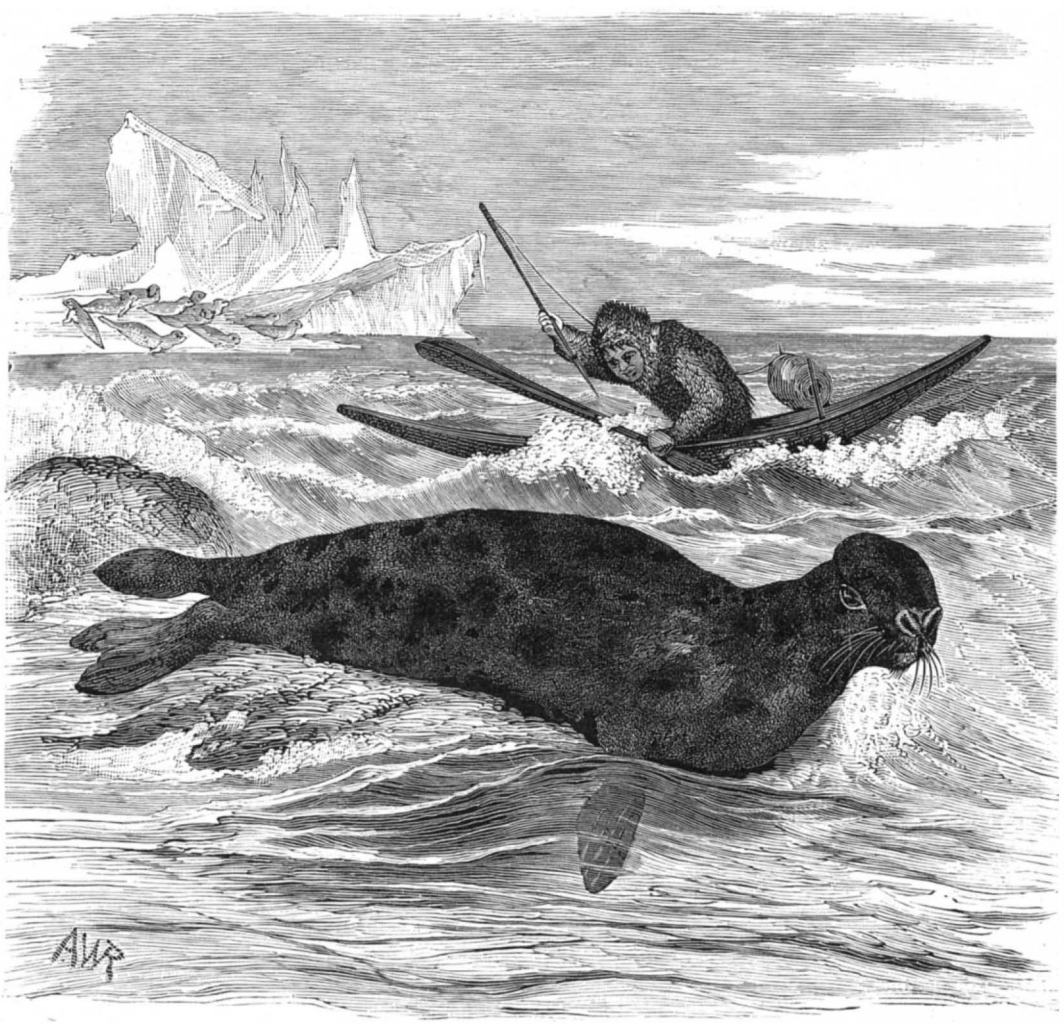
The bladder-nose seal, or crested seal (*Cystophora cristata*), is an inhabitant of Southern Greenland. From September to March it frequents Davis's Straits for the purpose of bearing and rearing its young, and returning with its offspring in June, in very worn-out and poor condition. In July it takes another excursion, employing its time in regaining its health which it lost during the period of its former absence, so that by September it is very fat. Of late years large and well appointed steamers have been employed in the capture of seals, and many hundred thousands of these beautiful creatures are being murdered every year for their skins and oil. The color of the crested seal, when adult, is a dark blue-black on the back, shading off to a yellowish-white on the under part of the body. A number of large gray patches are scattered over the body, and in the center of each patch is a dark spot. The head, tail, and feet are black. The crested seal attains, when full grown, a length of 12 feet, and is stout in proportion. These seals have a habit of making and preserving holes through the solid ice, and which communicate with the open water. How these animals manage to pass up these perpendicular openings, the insides of which are perfectly smooth and from four to five feet in depth, seems wonderful, yet they accomplish this feat with entire ease. The cyst or crest is common to the male seal only. It extends from the mouth over the upper jaw and the larger portion of the head. It can be inflated with air and emptied at will. When filled it forms a bag or cushion-like protuberance of 25 centimeters in length and 20 centimeters in height. When collapsed it resembles a keel, dividing the nose into two equal portions. The head is large, the snout thick and rotund. After much discussion and nonsense regarding the utility of the crest or cap of this variety of seal, it is generally admitted by naturalists that at present they have not been able to obtain any positive and definite evidence as to its use.

In the preparation of the skin of this seal the long coarse hairs have to be removed, leaving only the soft fur adherent to the skin. This is accomplished by heating the skin and scraping it, while hot, with wooden knives.

A young specimen of this seal was purchased by the New York Aquarium some time ago; it lived for a few weeks, dying at last from refusal of food. While in captivity it was very surly and ferocious. When angered it inflated its crest with air.

The seal most common on our Northern and Eastern coasts is known as the harbor seal (*Phoca vitulina*). It was only a few years ago that individuals of this variety might often be met in the East River on their passage from the ocean to Long Island Sound. Even nowadays the bark of the seal at nights is no uncommon sound as near to New York city as Gravesend Bay. The harbor seal is a beautiful animal, with its handsomely mottled skin, and large, intelligent, liquid eyes, and comfortable looking, rotund body, which tempts one to caress and fondle it, and stands it well in point of beauty, grace, and intelligence far above all other members of the seal family.

A fisher friend of mine, living on one of the small islands in the Bay of Fundy, had acquired the knack of "calling" young seals to the side of his dory when tending his herring weirs at night. One of them, so small and plumpy in its baby seal skin and large, wondering eyes, tempted him to steal it from its mother and take it home to his children to raise as a household pet. In course of time the young seal was weaned from the nursing bottle and placed on a diet of young herrings. This seal became greatly attached to all the members of the family, particularly the children, and would show great distress when not allowed to go with them in their boats. He always accompanied his master when tending the herring weirs, either swimming alongside the boat or sitting upright on one of the seats. It would lie for hours stretched out under the kitchen stove. On warm sunny days it would swim off to the neighboring ledges of rocks and mix with its friendly relatives, returning at evening to have a romp with the children in the water.



CRESTED SEAL.

The Beetle Crop of Southern Russia.

In many parts of Kharkoff, Southern Russia, the only harvest reaped this year has been that of the corn beetle, *Anisoplia austriaca*, many tons of which have been gathered and officially reported. Fifteen years ago this insect pest invaded the northern shore of the Black Sea. The larva is first seen floating on the waves; the final transformation occurs on the sandy shores, and the beetles proceed into the interior in vast swarms, increasing every year the area of their ravages.

How to deal with the evil is one of the great problems of to-day in Russia. Machines of all descriptions have been tried, but have proved more or less worthless, as indeed must all mechanical appliances against a pest so vast that a single field in Kharkoff was calculated in the spring to contain 350,000,000 insects. A short while ago it was said that a fly had been discovered with a propensity for killing corn beetles, and it may be safely assumed that it will only be by means of some such antagonistic insect or by the agency of birds—at present absent from the Russian steppes—that the evil will be ultimately suppressed.

The Flora of Volcanoes.

A traveler in Japan, Prof. Rein, published not long since some interesting observations, showing the distribution of vegetation on the sides of the volcanoes in Japan. This vegetation is continually being transplanted to higher levels, the ripe seeds being wafted upward by wind from the valleys, while to a certain degree, the reverse migration is produced by descending winds.

One of the higher mountain chains in Japan, that of Utaké, forms a group which extends nearly three kilometers from north to east. The southern peak is the youngest, having almost no vegetation, while the northern peak, and even its crater walls, are covered with an abundance of Arctic and Alpine plants. These plants, which have a large size in the plains, decrease in height and beauty as they ascend. A kind of vanguard is formed by *Polygonum weyrichii*, *Stellaria florida*, and *Carex tristis;* then follows usually *Alnus viridis*, with *Pyrus sambrecifolia*, and a remarkable species of *Schizozodon*, which is accompanied by a beautiful Alpine *Campanula*, larger than its European relatives. There are also found at a very great height flowers which are common in the forests of Central Europe. *Vaccinium vitis idœa*, *Oxalis acetosella*, and *Majanthemum* rise to nearly 3,000 meters (9,875 feet). The flora peculiar to Japanese mountains is found somewhat lower, and contains lovely *Ericineæ*, *Saxifragœ*, and many anemones.

This flora seems to have been carried to that country by the winds and streams of the sea, from Kamtschatka and Eastern Siberia.

The Cape Cod Ship Canal.

The long talked of ship canal across the peninsula of Cape Cod, Mass., has been surveyed, and preparations are making for the immediate prosecution of the material part of the work. The canal will be about eight miles long and without locks. It will connect Cape Cod Bay with Buzzard's Bay, and not only shorten the water route between New York and Boston by 90 miles, but will secure an in shore route between these cities practicable for such passenger and freight boats as now ply on Long Island Sound.

It is estimated that there is an average annual loss of 6,000 tons of vessel property, and from thirty to forty lives caused by ship wrecks, occurring around Cape Cod. The canal will be 141 feet wide at the top, and 6 feet wide at the bottom. It will have an average depth of 30 feet.

Vegetable Vessels and their Functions.

The renowned German physiologist, Professor Dr. Joseph Böhm, has recently published a pamphlet in which he expounds a new theory of the functions of the plant vessels. He explains the rising of the sap in the stem by the evaporation on the surface of the plant, and maintains that this evaporation creates a difference of pressure in the neighboring cells, and that consequently the water is drawn up from the lower layers of cells, where it is abundant, into the higher layers which contain only a small quantity. The chief object of his investigations was to ascertain what functions belong to those vessels or tubes which run through the whole lengths of the trunks of the trees, and which, in several kinds of wood, in the oak and maple for example, can be plainly seen with the naked eye in the cross cut. Heretofore these tubes have been taken in all cases for air-conducting organs, and have been called tracheæ, in analogy to the tracheæ of the human body. By careful experiments Professor Böhm has discovered that the vessels of many trees contain sap, not only when transpiration has paused, but at all times, even during rapid evaporation, they contain a quantity of water so great that air cannot be forced through them.

Further, he ascertained that twigs of many plants, of the willow, for example, notwithstanding their liquid contents, are capable of taking in water in such abundance that layers increase their weight twenty per cent within a few days. Now, according to Professor Böhm's theory, the interior of the sap-conducting cells in the unmutilated plant is submitted to a certain pressure, which is the consequence of the resistance which the water experiences on its way from the root to the assimilating leaves; but if the twig is cut liquid finds an easy entrance, and the sap-conducting cells partially suck in the contents of the vessels, while fresh water enters at the cut surface and the weight of the twig is increased. Therefore the tracheæ of the willow and the like are no air pipes, but water channels, which pour their liquid into the sap-conducting cells. These channels are obstructed after the layers have been for a long time in water by cells, the so-called thylls, which lay themselves right across the pipes. When the liquid is no longer conducted in this manner to the upper part of the twigs through the tracheæ, the rapid increase of weight ceases. The reason that the shoots in this state do not perish, but remain alive very often for five or six months without increasing in weight, is because the water ceases to rise through the tube vessels and only moves through the sap-conducting cells, this process being a very slow one. A similar function to that of the vessels of the willow tree probably belongs to the vessels of the horse chestnut, birch, linden, maple, etc., all of which, at the time of rapid transpiration, contain liquids. A series of other experiments with oak, acacia, catalpa, amorpha, and other trees, showed that the tracheæ of the young wood permitted the passage of compressed air, but that through those of old wood neither air nor water could be pressed. The reason for this is to be found in the obstruction of the old vessels by means of thylls or resinous substances. In the old trees the tube vessels are real "tracheæ," for they contained air having the tension of the atmosphere and were entirely without sap. Nevertheless, in such trees also, the streaming of sap from the root to the crown has to be kept up. This is done as in the shoots of the willow trees, whose ends, after a longer cultivation, are obliterated by the thylls; they filter the sap from cell to cell in order to restore the equilibrium between the contents of the superimposed cells which was disturbed during the transpiration. The consequence is that in the higher sap-conducting cells the tension of air must be very low, because, otherwise, the drawing up of the liquid would be impossible. This attenuation of air, at a certain age, finally reaches its minimum, the atmospheric air is given up to the cells from the neighboring vessels, and therewith one factor for the rising of the sap is eliminated. Now, no more water ascends in these tubes, the wood has changed from the sap-conducting alburnum to ligneous fiber. The duration of this process in the different kinds of wood, whose vessels contain atmospheric air, varies. Even in the single individuals of the same species it is hastened or retarded by several causes, such as clime, location, etc.; but the natural death of the tree by

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enervation is always the consequence. The feeble layer of live peripheric wood is no longer able to give nourishment to the large crown of the tree, formation of new wood has nearly ceased altogether, and every year a new number of branches die out, while only here and there a desolate twig, whose few leaves have a conspicuous, light color, show that life still lingers in the old trunk, but that in a short time its end will come.

The process is different in those wood plants the vessels of which, even in old age, are still filled with liquid, such as the birch and the willow. Their death is not caused by enervation, but their vessels and tubes, full of sap, enter into a state of dissolution, which is introduced by the action of fungi and other parasites which take up their abode inside of the vessels. Finally decay spreads out more and more, new parts of the healthy wood are attacked and fall into pieces, till a strong blast of wind ends the long disease

BENZOLE.

This name is applied to a lightly oily liquid consisting of equal equivalents of hydrogen and carbon. Since the atom of carbon is twelve times as heavy as that of hydrogen, of course benzole contains twelve times as much carbon by weight as it does of hydrogen. Its percentage composition is: Carbon, 92·3; hydrogen, 7·7. Not every substance, however, having this percentage composition is benzole, for acetylene, a bad smelling gas, has the same composition, and chemists say they are isomeric. To benzole they give the formula C_6H_6, meaning there are six atoms of each element in the molecule, while acetylene has but two of each, and is written C_2H_2. How do they know this? it may be asked. Because the vapor of benzole is three times as heavy as that of acetylene; the former being 39, the latter 13, with hydrogen as a unit.

Before passing on to a description of benzole and how it is made, we must refer to the confusion caused by its having too many names. Faraday, who discovered it in 1825, called it bicarburet of hydrogen, because in those days the atomic weight of carbon was but half as large as now. Next it was called benzene, and this name still adheres to it in England and France, while in Germany and this country it is called benzole. Here the term benzine is limited very properly to the light petroleum oils which boil between 80° and 100° C.

Pure benzole is formed by heating benzoic acid with quicklime. In a less pure form it is obtained when organic matter is highly heated; thus, Faraday found it in illuminating gas made by heating the fatty oils, and Woehler made it by the dry distillation of quinic acid. At the present time it is usually made from coal tar, the refuse of the gas house, in which it was discovered by Leigh in 1842, and by Mansfield in 1847.

Coal tar is a mixture of a great number of different bodies, both solid and liquid. By distillation it is separated into three portions: the first, boiling below 150° C. (302° F.), is called light oil; the second portion is heavy oil, or dead oil, while a sort of pitch remains behind. Benzole is made from the light oil, and the commercial article is very impure, containing only 40 per cent of benzole; the remaining 60 per cent is chiefly toluol, C_7H_8, a substance quite similar to benzole, but of higher boiling point and richer in carbon. This impure benzole makes better aniline dyes than the pure, as we shall afterwards see. By careful fractional distillation a nearly pure benzole is obtained, which is then still further purified by freezing it and pressing out the crystals. Pure benzole boils at 80° C. (177° Fah.), and when cooled solidifies, forming tufts of crystals, which melt at 5½° C. (42° Fah.). It is insoluble in water, but soluble in alcohol, ether, and wood spirits. It possesses remarkable solvent properties, surpassing those of benzene or petroleum naphtha. It is an excellent solvent for India-rubber, gutta percha, the fixed and volatile oils, wax, and camphor; it also dissolves copal, gum lac, sulphur, phosphorus, and iodine, as well as a very large number of organic bodies. It is very inflammable and burns with a smoky flame. Many accidents have occurred from heating or distilling it over an open fire. If it is mixed with two volumes of alcohol it can be used as a lamp oil. When illuminating gas is passed through benzole its illuminating power is greatly increased. An apparatus for enriching poor gas is sold under the name of Woodward's carbureter.

The most remarkable and valuable property of benzole is its ability to form substitution and addition compounds. Chlorine is able to *replace* each and every atom of hydrogen in benzole, and, besides this, one or more atoms of chlorine, to the number of six, can be *added* to the molecule of benzole.

Mono-chloro-benzole, C_6H_5Cl, is formed when chlorine is passed into benzole containing iodine. It boils at 138° C. There are two kinds of dichloro-benzole, one melting at 53° C., the other below zero. There are also two kinds of trichloro-benzole, as well as of the tetrachloro-benzole. Of the pentachloro-benzole, of course, but one form is possible if Kekule's ring-shaped formula is true; yet Jungfleisch and Otto both assert that they have made two kinds. When all six atoms of hydrogen are replaced by chlorine we have a chloride of carbon C_6Cl_6. It is made by pouring benzole on antimonic chloride and then passing in chlorine as long as it is absorbed. It forms silky needles, melting at 220° C.

Thus it will be seen that benzole forms at least nine chlorine substitution compounds. With bromine and iodine it forms nearly as many, although the latter are more difficult to prepare. By the action of chlorine upon benzole in sunlight an additive compound, $C_6H_6Cl_6$, is formed, and in like manner chlorine may be added to the substitution compounds forming such bodies as $C_6H_5Cl_7$ and $C_6H_4Cl_8$.

A much more important series of substitution compounds is that formed by the action of nitric acid on benzole.

Nitro-benzole, $C_6H_5NO_2$, in which an atom of hydrogen is replaced by the NO_2 group, is a yellow oil, heavier than water, and of an agreeable odor, resembling that of bitter almonds. In commerce it is known as essence of mirbane. It is formed when benzole is poured slowly into fuming nitric acid as long as the benzole dissolves. The mixture is then poured into a large quantity of water (in which it sinks) and thoroughly washed. It should next be distilled in a current of steam, and may afterwards be distilled *per se*. On a large scale it is prepared by acting on benzole with sulphuric acid and sodic nitrate, or a mixture of ordinary nitric acid (sp. gr. 1·3) and strong sulphuric acid. It is a violent poison when taken internally, two drops having in one case caused death. When pure benzole is employed in its manufacture the purified nitro-benzole boils at 210° C.; when commercial benzole containing toluol is employed the resulting product is a mixture of nitro-benzole and nitro-toluol, and boils at a much higher temperature.

When nitro-benzole is acted upon by a mixture of sulphuric and fuming nitric acids, a solid dinitro-benzole is formed, which crystallizes in long needles. It is soluble in alcohol, but insoluble in water.

In addition to the two nitro-benzoles, there are several nitro-chloro-benzoles, as well as nitro-bromo and nitro-iodo compounds.

The nitro-benzoles are readily converted, by means of reducing agents, into amido compounds by substituting NH_2 for NO_2. Amido-benzole, $C_6H_5NH_2$, which is much better known under the name of aniline oil, is prepared on a large scale by the action of acetic acid and iron filings on nitro-benzole.

Aniline was first discovered by Unverdorben in Saxony in 1826, among the products of the distillation of indigo. In 1833 Runge discovered it in coal tar, and called it kyanol. In 1842 Zinin, recently deceased, prepared it from nitro-benzole by reduction with sulphhydric acid; he called it benzidam. A. W. Hofmann, of Berlin, subsequently proved the identity of all these substances. The name aniline was given to Unverdorben's new compound by Fritzsche from *anil*, meaning indigo.

Pure aniline is a colorless liquid of bitter taste and unpleasant odor, which soon turns brown in the air. It boils at 184·8° C. The admixture of toluidine, etc., raises its boiling point.

When heavy aniline oil of higher boiling point is treated with certain oxidizing substances it is converted into a base called rosaniline or fuchsine, $C_{20}H_{19}N_3$, the salts of which have a beautiful green color when solid, a magnificent red when in solution. Arsenic acid is the reagent mostly employed in making rosaniline, although corrosive sublimate, nitro-benzole, and perchloride of tin are also used. A description of the methods employed in the manufacture of the aniline colors would far exceed the limits of our present article.

Diazo-benzole is a benzole derivative containing, as the name implies, two atoms of nitrogen. It is obtained as a nitrate by passing nitrous acid gas into a solution of the nitrate of aniline. Also as the hydrochlorate by dissolving aniline in an excess of hydrochloric acid and adding potassic nitrite. In a dry state the diazo compounds are dangerously explosive, and even in solution undergo spontaneous decomposition. By the action of various diazo compounds upon the phenols, Griess has obtained a great variety of dyes, some of them quite interesting and beautiful, and still they come. James H. Stebbins, Jr., of this city, has also made a number of dyes from diazo compounds.

Sulphanilic acid, $C_6H_7NSO_3$, is formed by the action of sulphuric acid upon aniline at a high temperature; in the cold only sulphate of aniline is formed. It crystallizes from hot water in rhombic plates. Two other acids having the same composition may be obtained, the one from sulpho-benzoic acid, the other from nitro-benzole. In making the former acid, sulpho-benzoic acid is first converted into a nitro-sulpho-benzoic acid, and that reduced to amido-sulpho-benzoic acid. It crystallizes in white needles.

In the above sketch we have described but a few of the most important derivatives of benzole. The list might be prolonged to an almost limitless extent by adding the various chloro and nitro derivatives of each of the above compounds, the acids derived from them, their salts, ethers, and esters; but these must wait until they have become of greater industrial or technical importance than they are at present, before they can claim a place in our crowded columns.

The Leather Industry of Philadelphia.

One of the oldest of the staple industries in Philadelphia is the manufacture of Morocco leather, which began early in the present century, and was an outgrowth of the East India trade that once distinguished that port, and continued fitfully until 1861. The Morocco leather manufacture, however, grew steadily, and is now more prosperous than ever before. There are thirty establishments, says the *Public Ledger*, making goat skin Morocco to the value of $5,056,000 for the last year, as compared with twenty-three in 1870, then producing $2,307,113 in value. The improvement effected by the introduction of steam machinery has given most of this increase, and the demand for fine leather in shoe manufacture takes all that the factories can produce. A few cases have been sent to foreign markets, but it is not a regular trade, as the export of sole leather has become. More than half the supply of sumac, the chief tanning material, is now produced in Virginia; formerly it was all brought from Sicily.

Next to the Morocco manufacture is that of calf-kid and glove-kid, nine factories producing $1,050,000 in value, as compared with $574,043 in 1870. A still larger product is that of colored and fancy leathers, bindings, and linings, chiefly of sheep skin, fifteen establishments producing $1,500,000 in value, as compared with $1,133,568 in 1870. The tanning of heavy leather, sole and upper, has declined, and many of the old yard tanneries have disappeared. But six or seven remain, producing $314,000 in value, as compared with $523,000 in 1870. A large industry remains in currying and preparing leather, although this has declined under the competition of the great steam tanneries of the interior of the State. The produce of about twenty of those tanneries is regularly sold in Philadelphia, one-half of it for export to foreign countries. The value, so handled, is about $6,000,000, and is increasing.

The only feature of the old order of things remaining is the importation of French and Belgian calf skins, which continues at about $750,000 in value yearly, although in the manufacture of calf-kid and like leathers here, the Alsatian and Belgian workmen, transplanted bodily to Philadelphia, give to Canal street and St. John street the air and flavor of the most ancient city of the continent. The only thing lacking, it is said, is time. The continental tanner has months or years before him without limit, whereas time with us is cut off at both ends, and the leather must be out of the tannery in a month. So Philadelphia brings into North Third street every year half a million dollars' worth of the best products of the North of France and adjacent Germany, leaving the poorest for Europeans to wear, because our bootmakers will have the best of French calf skins, or none at all.

In manufactures of leather, including every form of cut leathers in belting, bands, harness, straps, etc., the industry is conducted with great activity. Belting is made for export, and the clean and perfectly finished belts of Pennsylvania leather are now driving machinery in England and Scotland, in Sweden, and in Australia. Even the great factories of Mulhouse would have procured 46-inch belts here if they could, but in France the importation of manufactures of leather is prohibited.

In leather strictly, embracing none but finished forms, the total value of that manufactured for the past year is $8,000,000—an increase of 33 per cent over 1870. The establishments are little subject to depression, and rarely to disturbance. Whatever may happen to other departments of business, the special forms of leather made in Philadelphia are always in demand, and there is no record of a corner in the market for Patna or Tampico goat skins.

MECHANICAL INVENTIONS.

Mr. Freadrick P. Danunhauer, of Philadelphia, Pa., has patented an improved apparatus for dyeing yarns which consists, first, in a series of nipping rollers hung on vibrating arms and fitted for movement to and from the supporting bars of the yarn to draw the yarn around the bars a regulated distance at each vibration; second, in an automatic stop motion for shifting the driving belt and stopping the mechanism when the desired number of turns have been given to the skeins, so that they may be removed.

An improved retracting device for the picker sticks of looms has been patented by Mr. James J. Geoghegan, of Westerly, R. I. The object of this invention is to provide a simple, durable, and inexpensive device for pulling back the picker sticks of looms, whereby the expenses and delays consequent upon the frequent breaking of the ordinary picker stick spring will be avoided. The invention consists of a rocking lever to one end of which the picker stick is connected, while to the other end weights or springs are attached to pull back the picker stick after each forward motion.

Messrs. Richard Matthai and Charles A. Clinton, of San Francisco, Cal., have invented a simple device for indicating to railroad car passengers the names or numbers of streets and stations on the line of the road as the car approaches them. The invention consists of a box or case containing rollers over which is rolled an index strip having the names or numbers of the streets and stations printed on it, which names or numbers are exhibited in proper succession through an aperture in the box as the rollers are revolved; and also of a novel combination of wheels, springs, levers, and other devices, whereby the said rollers are moved and a bell simultaneously sounded when desired.

Causes of the Present Figure of the Earth.

The *Comptes Rendus* of the French Academy contains a remarkable paper by M. Faye on the physical forces which have produced the present figure of the earth. After remarking on the use of the pendulum in determining the figure of the earth from series of measurements of the intensity and direction of the gravitation force at different parts of the earth's surface, he draws attention to the very curious fact that while the direction and intensity of gravity are affected perceptibly by the presence of hills such as Schichallion and Arthur's Seat, or even by masses as small as the great pyramid of Gizeh, gigantic mountains such as the Himalayas, and great elevated plateaux and table-lands, do not affect the pendulum indications in any sensible man

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ner, except in certain cases where upon elevated continents there appears to be a veritable defect of attraction instead of the excess which might be expected. Indeed, the observations are sufficiently striking to seem to point to the supposition that not only under every great mountain, but even under the whole of every large continent, there were enormous cavities. More than this, the attraction at the surface of all the great oceans appear too great to agree with the distribution presumed by Clairant's formula, which is exact enough for most purposes. Sir G. Airy's suggestion that the base of the Himalaya range reaches down into the denser liquid interior, and there displaces a certain amount of that liquid, so that the exterior attraction is thereby lessened, is one which, inherently improbable, fails to have any application in explaining why the attraction above the seas should be greater than over the continents. M. Faye propounds the following solution to the difficulty: *Under the oceans the globe cools more rapidly and to a greater depth than beneath the surface of the continents.* At a depth of 4,000 meters (13,000 feet) the ocean will still have a temperature not remote from 0° C., while at a similar depth beneath the earth's crust the temperature would be not far from 150° C. (allowing 108 feet in depth down for an increase of 1° in the internal temperature). If the earth had but one uniform rate of cooling all over it, it would be reasonable to assume that the solidified crust would have the same thickness and the same average density all over it. It is therefore argued that below the primitive oceans the earth's crust assumed a definite solid thickness before the continents, and that in contracting, these thicker portions exercised a pressure upon the fluid nucleus tending to elevate still further the continents. This hypothesis, M. Faye thinks, will, moreover, explain the unequal distribution of land and sea around the two poles, the general rise and fall of continents being determined by the excess of density of the crust below the oceans, and by the lines or points of least resistance to internal pressure being at the middle of continents or at the margin of oceans.

How the Pyramids were Built.

Brugsch Bey, the eminent Egyptologist, says, in his work on Egypt:

From the far distance you see the giant forms of the pyramids, as if they were regularly crystallized mountains, which the ever-creating nature has called forth from the rock, to lift themselves up toward the vault of heaven. And yet, they are but tombs, built by the hands of men, which have been the admiration and astonishment alike of the ancient and modern world. Perfectly adjusted to the cardinal points of the horizon, they differ in breadth and height, as is shown by the measurements of the three oldest, as follows: 1. The Pyramid of Khufa—height, 450·75 feet; breadth, 746 feet. 2. Pyramid of Khafra—height, 447·5 feet; breadth, 690·75 feet. 3. Pyramid of Menkara—height, 203 feet; breadth, 352·78 feet.

The construction of these enormous masses has long been an insoluble mystery, but later generations have succeeded in solving the problem. According to their ancient usages and customs, the Egyptians, while they still sojourned in health and spirits, were ever mindful to turn their looks to the region where the departing Ra took leave of life, where the door of the grave opened, where the body, well concealed, at length found rest, to rise again to a new existence, after an appointed time of long, long years, while the soul, though bound to the body, was at liberty to leave the grave and return to it during the daytime, in any form it chose. In such a belief, it was the custom betimes to dig the grave in the form of a deep shaft in the rock, and above this eternal dwelling to raise a superstructure of sacrificial chambers sometimes only a hall, sometimes several apartments, and to adorn them richly with colored writings and painted sculptures, as was becoming to a house of pleasure and joy. The king began his work from his accession. As soon as he mounted the throne, the sovereign gave orders to a nobleman, the master of all the buildings of his land, to plan the work and cut the stone. The kernel of the future edifice was raised on the limestone soil of the desert, in the form of a small pyramid built in steps, of which the well constructed and finished interior formed the king's eternal dwelling, with his stone sarcophagus lying on the rocky floor. Let us suppose that this first building was finished while the Pharaoh still lived in the bright sunlight. A second covering was added, stone by stone, on the outside of the kernel; a third to this second, and to this even a fourth; and the mass of the giant building grew greater the longer the king enjoyed existence. And then, at last, when it became almost impossible to extend the area of the pyramid further, a casing of hard stone, polished like glass, and fitted accurately into the angles of the steps, covered the vast mass of the sepulcher, presenting a gigantic triangle on each of its four faces.

More than seventy such pyramids once rose on the margin of the desert, each telling of a king of whom it was at once the tomb and monument. Had not the greater number of these sepulchers of the Pharaohs been destroyed almost to the foundation, and had the names of the builders of these which still stand been accurately preserved, it would have been easy for the inquirer to prove and make clear by calculation what was originally, and of necessity, the proportion between the masses of the pyramids and the years of the reigns of their respective builders.

ALUM and plaster of Paris, well mixed in water and used in the liquid state, form a hard composition and also a useful cement.

Correspondence.

Protection from Lightning.

To the Editor of the Scientific American:

In your paper of August 28 is an article written by Professor Kirchoff, on connecting lightning rods with gas and water mains, in which, after citing a case of lightning destroying several lengths of cast iron water pipe in Basch, he proceeds to state that if the said pipes had been joined with *lead* instead of pitch, no mechanical effects could have been produced.

That the assumption of Professor K. is not justified by the facts is proved by the following cases:

A church in Terre Haute, Indiana, was struck by lightning, the rod knocked down, after which the electricity followed the gas pipes in the church to the mains in the street, and melted the *lead* joints for upwards of one thousand feet.

Another church in Iowa City, Iowa, received a heavy discharge, which damaged the rod, ran on the gas pipes, and thence to the main, and for a distance of several hundred feet every particle of the *lead* joints was burned out.

Other cases might be cited, but these are sufficient to prove that *lead joints* do not prevent mechanical effects when lightning passes over gas pipes.

Another correspondent, in the same issue of your paper, J. C. M., of Bradford, Pa., writing on the subject of protecting oil tanks from damage by lightning, says:

"We would only be too glad to learn of some method other than the old theory, by which we could protect our property from lightning, as that has been demonstrated beyond a doubt to be a failure. We want information on the subject."

J. C. M. is only one of many thousands seeking such information, and it certainly should be forthcoming from some of our scientists. Of what practical value to the human family has been the vast amount of knowledge accumulated on the subject of atmospheric electricity within the last forty or fifty years? Our scientists have studied its modes of action until all agree upon the laws which govern it; yet, so far as protection from lightning is concerned, this knowledge has not helped us forward one single step. The scientific world has demonstrated clearly, and have taught us by their writings for half a century, that what is known as *electric induction* is a universal mode of electric action.

Scientists have also clearly proved that Franklin knew nothing of this law of electric induction, hence that his theory regarding the action of atmospheric electricity was erroneous. Is it not strange, then, that our scientists should to this day countenance a system of lightning protection (so-called) suggested and recommended by Franklin, and which, by him, was based upon what has been so clearly proved to have been an erroneous theory? Is it reasonable or logical to expect protection from a system founded upon such a basis? Had the great Franklin understood electric induction, his wonderful intuition would have enabled him, without doubt, to suggest the proper method of constructing apparatus for protecting our property from lightning.

Electric induction is theoretically acknowledged and taught by all scientific authorities, yet when the subject of devising some practical system of protection from lightning is under consideration, these same authorities as completely ignore this law of electric induction as did Franklin, who, they prove, knew nothing about it.

Before we can hope for any efficient system of protecting our property from the dire effects of the lightning stroke, it must be clear to inquiring minds that we must no longer ignore this wonderful law of electric action known as electric induction, but must keep it ever before us and recognize it as an all-important and indispensable factor in our investigations. Any other course must result in the future, as it has in the past, in total failure. J. H. A.

Cleves, Ohio, September, 1880.

REMARKS.—Our correspondent's letter is chiefly valuable in reporting the two churches that were struck, the rods of which were connected with the underground gas pipes. It is undoubtedly true that lead is a poor conductor, and that when a heavy discharge of electricity passes along leaded pipe joints, mechanical effects will sometimes be produced. The object in connecting the rods with the gas pipes is to enlarge the connection of the rods with the earth, and thus to protect life and property in the building. If this is accomplished (and it seems to have been done in the cases cited by our correspondent) then the temporary mischief resulting to the lead joints is of no importance, as it may be readily repaired. The connection of the rod with water or gas pipes is recommended, although lead joints are known to be electrically bad, because such pipes usually form the best available means of connecting the rods with the ground.

Our correspondent assumes that Franklin was an ignoramus in respect to atmospheric electricity, and that his system of protection by lightning rods is good for nothing, not being based, as he supposes, on the "wonderful law of electric induction."

We think the probable difficulty is with our correspondent and not with Franklin, who was not, as our correspondent assumes, ignorant concerning atmospheric electricity. Franklin's original instructions relative to lightning rods have been proven by experience to be substantially correct; furthermore, they agree with the theory of "electric induction," and are as sound and good in practice to-day as they were when first published by the illustrious inventor in 1753. Franklin taught that in order to protect buildings the rod should be carried down into moist earth; and the proper inference from his instructions is that he considered it essential that the bottom of the rod should always be well grounded in the earth. All experience with rods since Franklin's time proves the correctness of this idea; and in almost every case where rods are used and damage is done, it is found that the earth connection of the rod was bad, and that Franklin's directions were not followed.

When our correspondent can produce an authentic example of a properly-rodded building, having its rods and metals thoroughly connected with the earth, that has been seriously damaged by lightning, then it will be time enough for him to assume that Franklin knew nothing about the subject, and that his lightning rods are of no account.—EDS. SCI. AM.]

COUNT LOUIS FRANCOIS DE POURTALES.

Science has recently met with a heavy loss in the death of Count Louis François de Pourtales, which occurred at Cambridge, Mass., July 18. His strong frame and temperate mode of life gave hope of a long period of usefulness, for he was only fifty-seven, and in the prime of his powers; but, stricken by an obscure internal disease, he succumbed after some weeks of suffering, and thus followed his teacher and companion, Louis Agassiz, after seven short years. Count Pourtales was a Swiss representative of an old family, which had branches also in France, Prussia, and Bohemia. He was educated as an engineer, and in early manhood emigrated to the United States at nearly the same time as his subsequent fellow worker, Agassiz, to whom he was warmly attached. He entered the government service in the department of the Coast Survey, and continued in it many years. Almost from the beginning of his duties therein he deeply interested himself in deep sea questions, and some of the earliest observations on the nature of the deep sea bottom and of Globigerina mud were made by him. By the death of his father, Pourtales succeeded to the title and received a fortune which enabled him to devote himself entirely to his favorite studies, and to do much in continuing the great work of Louis Agassiz. Receiving the appointment of Keeper of the Museum of Comparative Zoology, he devoted himself untiringly to carrying out the arrangement planned by his friend and master. Dividing the task with the curator, Alexander Agassiz, he pushed forward his part of the work with the easy power of a strong and highly trained intellect, and was the very model of an administrative officer. In 1871 he published (in Catal. Mus. Comp. Zoology, iv.) what is probably his best known work—"Deep Sea Corals"—a memoir containing valuable disquisitions on the affinities of various genera, notes on the distribution of species, and the nature of the bottom on which the dredgings were made. A second memoir on the same subject was contributed by him to the account of the zoological results of the Hassler expedition, and many others in this and other zoological subjects are to be found in the Bulletin of the Harvard Museum of Comparative Zoology. His last work is a description of the plates of corals in the Report on the Florida Reefs by the late Professor Agassiz, which has just been published by Alexander Agassiz, through the permission of the Superintendent of the Coast Survey. These plates are the most perfect and beautiful representations of corals that have as yet been published anywhere, and were drawn under the immediate direction of Professor Agassiz. Count Pourtales' name is indissolubly connected with deep sea zoology by means of the genus *Pourtalesia*, which was dedicated to him. The *Pourtalesia*—a sea urchin allied to *Ananchytes*—was found by the Challenger expedition to be one of the most ubiquitous and characteristic of deep sea animals, and numerous species new to science were obtained by the expedition.

Pourtales' range of learning was very extensive, and his command of it perfect. Nor was it confined to mathematics, physics, and zoology. He did not scorn to read novels and light poetry, and was knowing in family anecdotes and local history. It was a common saying in the museum that if Count Pourtales did not know a thing it was useless to ask any one else.

RECENT INVENTIONS.

An improvement in hoppers in which grain or middlings, etc., are placed to be fed to crushing rolls, purifiers, or other milling machinery, has been patented by Mr. John T. Cook, of Jordan, Minn. One side of the hopper is hinged and movable, and the invention consists in the combination, with the hinged part, of devices, which allow it to yield to the pressure of the grain or middlings and swing outward, but restrict its movement within certain limits, so that the grain shall not discharge too rapidly.

An improved thread case, which exhibits the thread to the greatest advantage, and permits of getting any desired kind of thread instantly and easily, has been patented by Mr. Eugene L. Fitch, of Breda, Iowa. The invention consists in a case with a glass front and top, and with a floor inclined from front to rear, and provided with a series of drawers, each containing a number of spools of thread which are held by spring catches at the end of the drawer, so that if a button on the drawer is pulled a corresponding spool will drop from the drawer and roll down the inclined floor toward the salesman.

A combined door plate and letter receiver, patented by Mr. Henry Free, of Lewiston, Me., is so constructed as

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to keep rain, snow, wind, and cold from entering the opening in the door, and it will allow the name or number to be readily changed.

An improved book holder, which is simple, effective, and convenient, has been patented by Mr. Wilhelm F. Eppler, of Herrstein, Germany. It is formed of a box, for lunch or other articles, and of two boards, between which the books are placed. All the parts are held together by cords attached to a slate placed below the lunch box or to the box itself, and are wound upon the revolving handle of the book holder.

Mr. Benedict Beehler, of St. Louis, Mo., has patented a lumber polishing machine, which is more particularly intended for polishing thin lumber, such as is used for making cigar boxes, and for similar purposes. It consists in a novel arrangement of a stationary bed plate and a tightly-journaled cylinder, whereby provision is made for simultaneously polishing both sides of the work as it passes through the machine.

REASONABLE DILIGENCE.

A very recent decision of the Supreme Court, at Washington, strikingly illustrates the importance of an inventor's using reasonable diligence and promptness in prosecuting his application. It is well understood that delay in this respect does not necessarily forfeit one's rights. Inventors may, if they can, keep their inventions secret, and if they succeed in doing so, no postponement of the application for a patent will deprive them of their right to one. The delay may be satisfactorily explained or excused; as where poverty, sickness, absence from the country, or the like, hinders early action. But, generally speaking, whoever has sufficiently matured a valuable invention will do well to seek a patent without dallying, as Mr. Woodbury in the case now to be narrated, has learned.

In the fall of 1846 Woodbury completed an improvement in planing machines. The nature of it is not important to the story; it involved the introduction of a "yielding pressure bar" to keep the wood to be planed firmly in position, instead of the rollers employed in previous machines constructed on the "Woodworth" general plan. It was a real improvement; and, as developed in other hands, has now acquired value.

But in 1848, when Woodbury filed application for a patent, his invention seems not to have been appreciated. It was rejected (in 1849), and he was notified he might "withdraw or appeal." He did not appeal. In 1852 the attorney through whom the application was made withdrew it. This was done without authority, to be sure, but Woodbury made no attempt, when informed, to have the case reinstated. Meantime he took out other patents, showing that he was not prevented from acting in the matter by ill-health or want of money. At last, in 1870, he renewed the application, and a patent was (in 1873) granted. He organized a company, which commenced introducing the machine to profitable use. But meantime the principle of the invention had been adopted by other persons. The planing machine company sued these for infringement; and one of them resisted the suit on the ground that Woodbury's delay was an abandonment of his invention to the public.

The Supreme Court has sustained the defense. They say that there is no rule requiring intention to abandon to be declared in words. It is the unquestionable right of an inventor to confer his invention upon the public, and this he may do by his conduct, and may do it after applying for a patent as well as before. The patent law requires him to be vigilant and active in taking steps to procure a patent if he desires one. He cannot, without cause, hold his application pending during several years, leaving the public uncertain whether he intends to prosecute it, and yet keeping the field closed against other inventors. It is not unfair to one who has for many years neglected a claim, that the public and the courts should treat it as abandoned.

THE CAUSES OF TERRESTRIAL MAGNETISM.

In his memoir entitled "Theory of Electric Phenomena," Mr. Edlund has explained the galvanic effects by a current of ether in the circuit, and the electrostatic phenomena by condensations and rarefactions of this ether. If this explanation is correct, then it follows that an isolating body moving with a celerity similar to that of the ether in a galvanic current must produce the same phenomena. To verify this idea Mr. Selim Lemström has constructed a paper tube with two concentric walls, which can be rapidly moved round a cylinder of soft iron which is freely suspended in the direction of the vertical axis of rotation. In employing a pair of astatic needles furnished with a mirror and suspended on a very fine silver thread, this gentleman has succeeded in ascertaining that this double-walled paper tube acts like a galvanic current and magnetizes the soft iron cylinder in the one or the other sense according to the direction of the rotation.

According to the geologists, the crust of our earth has two per cent of iron, and supposing that all the magnetic molecules are concentrated in one layer forming the inside of this crust, then this crust of magnetic matter would have the thickness of about 1 kilom. (five-eighths of a mile). This magnetic layer, which is about 30 kilom. (18·75 miles) below the surface, having nearly the shape of a sphere, may be considered, as regards its magnetic effect, as a real sphere when influenced by a certain force.

The earth being a magnetic body, suspended in the ether and turning around its own axis, will, from a magnetic point of view, be magnetized in the same way as if it were itself at rest, while the ether would move around it in an opposite direction. Going out from this theory, after finding by calculation the force which guides this molecular magnet following the axis of the earth, and after ascertaining the magnetic momentum, we have mathematical values which, corresponding to the formula of Gauss, explain the position of the magnetic axis of the earth, as well as its secular, annual, and daily variations, and which are in perfect accordance with the accidental phenomena, such as magnetic tempests and the aurora borealis.

THE LOCATION OF THE LICK OBSERVATORY.

In his report to the trustees of the James Lick Trust, with reference to his observations on Mount Hamilton, California, to determine the suitability of the summit of that mountain for the site of the proposed observatory, Mr. S. W. Burnham concludes that it offers advantages superior to those found at any point where a permanent observatory has been established.

Mount Hamilton is thirteen miles due east (in an air line) from San José, Cal., the latter place being fifty miles south of San Francisco. The summit of the mountain is reached by a well-constructed highway, carried up by a circuitous route twenty-six miles long, and nowhere exceeding a grade of six feet in the hundred. The sides of the mountain, in most directions, are very steep, and form an acute angle at the summit, which is 4,250 feet above the level of the sea. The view from the peak is unobstructed, there being no higher ground within a radius of 100 miles. The atmosphere of the region is marvelously clear; indeed Professor Davidson, of the U. S. Coast Survey, in his work in the Sierra Nevada, at an altitude of 10,000 feet, was able to see with the naked eye the five-inch mirror of a heliotrope 175 miles distant.

Mr. Burnham had at his temporary observatory a six-inch refractor by Alvan Clark & Sons, with eyepieces giving powers up to 400; also a full set of meteorological instruments. He remained on the mountain from August 17 to October 16, with an absence of three nights in September. During these sixty days there were forty-two nights that were first-class for astronomical purposes, seven medium nights, and eleven that were cloudy and foggy. There was not one clear night when the "seeing" was not good. In the opinion of Professor Davidson, based on the observations and experiences of the members of the Coast Survey, good seeing may be expected 250 nights every year, and 150 of those nights will be such as are rarely experienced in the east. Though his telescope was a small one, and his positive micrometer (made to order for double star work by a prominent London optician) "combined more features which should be avoided in an instrument of the kind intended for actual service than were ever found in any other micrometer," Mr. Burnham was able during his short stay on the mountain to discover forty-two new double stars, and to make micrometer measures of ninety. Five wide pairs previously catalogued by Herschel, Struve, and South, were found to be close groups of three; and six of the new double stars are prominent well-known stars visible to the naked eye.

These discoveries, Mr. Burnham justly observes, show better than anything else can what may be done at Mount Hamilton. "Remembering," he continues, "that they were discovered with what, in these days of great refractors, would be considered as a very inferior instrument in point of size, we may form some conception of what might be done with an instrument of the power of that at the Naval Observatory, having a light power about nineteen times as great, or with the proposed Pulkowa glass of twenty-five times the power."

Two Disastrous Hurricanes.

A furious hurricane ravaged the Island of Jamaica on the afternoon and night of August 18, causing a vast amount of damage. The storm struck the northern side of the island, shifted to the northeastern side, then to the southeastern coast, whence it traveled westward. In two hours the wind increased from two miles an hour to eighty miles, and during the day the barometer fell a full inch.

Forty-three of the forty-five vessels lying in Kingston harbor when the storm broke were destroyed, and most of the shipping along the coast was wrecked. Scarcely anything material was able to withstand the force of the wind. Public buildings were demolished in an instant. The debris was whirled high into the air and conveyed to a great distance from the structure to which it originally belonged. At Raetown, for instance, a sheet of iron roofing, weighing upward of half a ton, was lifted to a height of fifty feet, rolled up like a stick of cinnamon, and was carried a distance of 130 feet from the building which it had covered. Cocoanut groves were entirely swept away, and the fruit crops in the places visited by the storm were entirely destroyed.

Wherever the cyclone struck the plantations were completely desolated. Looking inland from Port Antonio, it is said, a man can see for a distance of fifteen or twenty miles; and in the whole of that space not a growing plant, cocoanut, breadfruit, banana, cane, corn stalk, or yam vine has been left. The coffee bushes are torn and stripped of their berries. Thousands of cocoanut trees have been blown down on single plantations. The cyclone leveled hundreds of houses and churches. The reports show that in St. George District, Portland, 131 houses were wrecked, at Yallatis fifty-nine houses; in Bath District fifty houses; in the Parish of St. Catherine every church and many houses; at Newcastle twenty houses; and so on along about 200 miles of the coast. At Kingston the damage done is estimated at $600,000, and the sum total of loss by the cyclone is appalling.

Famine is feared in the districts devastated, so general was the destruction of the coffee, fruit, and food crops.

A hurricane, said to have exceeded in destructive violence the historical hurricane of 1839, swept over the islands of Bermuda, August 29 and 30. Many houses were wrecked and the entire fruit crop was destroyed. Great damage was also done to the public works, including the causeways. Many vessels in the path of the storm were wrecked, both around the islands and along the Florida coast, where the hurricane raged with great violence. The greatest loss of life attended the founding of the passenger steamship City of Vera Cruz, of the New York and Havana line. Of seventy passengers and crew but 13 were washed ashore alive, after battling with the sea for 24 hours or more.

Antimony in California.

Hitherto no workable ores of antimony have been known in this country, the chief source of the metal being the Sarawak Mine in the Island of Borneo. Ten years ago, while prospecting in Kern County, California, Mr. E. J. Weston discovered the sulphuret of antimony in an old mine worked long ago by a Jesuit society for gold. The property has since been purchased by Mr. S. Boushey and his two sons. The ore thus far taken out has been sent to France to be refined, and recently Mr. Boushey passed through this city on his way to California, having just returned from Paris, whither he had been to make arrangements for the erection of reduction works at the site of the mine. As described by Mr. Boushey to the *Sun*, the mine lies in Kern County, as above stated, thirty-five miles south of Bakersfield, near Sumner Station, on the Southern Pacific Railroad. Between the head-waters of the San Emidio and the Pleito Cañons there is a mountain face which for four miles consists of granite and porphyry covered with fertile earth and heavily timbered with pine. The ledges of granite and porphyry run parallel with the face of the mountain and slant with it at an angle of nearly forty-five degrees. The antimony is found in a true fissure, of which there are only three other instances in the world. There is one in Freiberg, one in Chili, and one in Mexico. This fissure is the result of the upheaval of what may be called one end of the mountain, or of the depression of its center. It strikes directly through the mountain at right angles with the granite and porphyry ledges. The ores with which it is filled were thrust up into it from below. At the top it is from thirty to one hundred feet wide, but it widens as it descends. The fissure has been traced across the top of the mountain five thousand feet, and antimony has been found at every point.

Mr. Boushey says that he has pushed four tunnels into his mine, one of them seventy-eight feet long. The rock is not hard, and one man is able to get out half a ton of it a day, carrying from thirty to sixty-five per cent of antimony.

A Great Bridge Reconstructed.

The great work of reconstructing the famous railway suspension bridge across the Niagara river has just been completed without interruption of traffic. The task was undertaken some months ago by Engineer E. A. Buck, and, though many prominent engineers doubted the feasibility of the plan, he has carried it out, making an iron and steel bridge out of a wooden bridge by a process of substitution which has not occasioned the slightest interruption of trains. The casual observer would never have suspected that anything more than a little repairing was going on.

The Bradford and Buffalo Pipe Line.

The United Pipe Line Company has recently completed an oil pipe line between Bradford and Buffalo. The pipe is 3 inches in diameter, and will transmit 125 barrels an hour. There are pumping stations at Cattaraugus and North Collins. Extensive refining works are being put up in Buffalo. A system of racks for loading tank cars and capacious tanks have been erected in East Buffalo. The racks are built along the railroad tracks a distance of about 500 feet, and there are 24 spill pipes for discharging oil into the cars.

The Long Bridge over the Volga.

The long bridge over the Volga, on the Syoran and Orenberg Railway, Russia, has just been finished. The river at the point is nearly a mile wide and fifty feet deep, and is subject to very heavy floods. Accordingly the fourteen piers carrying the bridge had to be built one hundred feet above the mean level of the water. The girders, three hundred and sixty-four feet long and twenty feet wide, were put together on the bank of the river and floated to their position. The cost of the bridge was 7,000,000 rubles, or $5,590,000.

The First Chinese Steamer to Cross the Pacific.

The Chinese steamer Hochung arrived at San Francisco August 30. The report that the Hochung was built in China, and sailed under Chinese command, with Chinese sailors and engineers, was not true. The vessel was built on the Clyde; the captain and three other officers were Danes, and the rest Englishmen. The seamen were mostly Chinese. Nevertheless, the arrival of the Hochung, under the Chinese flag, marks an important date in the history of navigation on the Pacific Ocean, as well as in the history of Chinese commerce.

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Business and Personal.

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For Mill Mach'y & Mill Furnishing, see illus. adv. p.147.

For Separators, Farm & Vertical Engines, see adv.p.157.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 157.

For Patent Shapers and Planers, see ills. adv. p. 156.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box423, Pottsville, Pa. See p. 157.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Soloman's Parallel Vise. Taylor, Stiles & Co., Riegelsville, N. J.

National Institute of Steam and Mechanical Engineering, Bridgeport, Conn. Blast Furnace Construction and Management. The metallurgy of iron and steel. Practical Instruction in Steam Engineering, and a good situation when competent. Send for pamphlet.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 172.

For Yale Mills and Engines, see page 173.

Reed's Sectional Covering for steam surfaces; any one can apply it; can be removed and replaced without injury. J. A. Locke, Agt., 32 Cortlandt St., N. Y.

Improved Solid Emery Wheels and Machinery, Automatic Knife Grinders, Portable Chuck Jaws. *Important*, that users should have prices of these first class goods. American Twist Drill Co., Meredithville, N. H.

For Standard Turbine, see last or next number.

Burgess' Non-conductor for Heated Surfaces; easily applied, efficient, and inexpensive. Applicable to plain or curved surfaces, pipes, elbows, and valves. See p. 284.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Don't buy until you see the $4 Drill Chuck; holds 0 to 9-16. A. F. Cushman, Hartford, Conn.

Diamond Drills, J. Dickinson, 64 Nassau St., N. Y.

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Wanted—The address of 40,000 Sawyers and Lumbermen for a copy of Emerson's Hand Book of Saws. New edition 1880. Over 100 illustrations and pages of valuable information. Emerson, Smith & Co., Beaver Falls, Pa.

The "Fitchburg" Automatic Cut-off Horizontal Engines. The "Haskins" Engines and Boilers. Send for pamphlet. Fitchburg Steam Engine Co., Fitchb'g, Mass.

For Wood-Working Machinery, see illus. adv. p. 190.

Eclipse Portable Engine. See illustrated adv., p. 189.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p.188.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

Nellis' Cast Tool Steel, Castings from which our specialty is Plow Shares. Also all kinds agricultural steels and ornamental fencings. Nellis, Shriver & Co., Pittsburg, Pa.

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For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

Elevators.—Stokes & Parrish, Phila., Pa. See p.189.

Penfield (Pulley) Blocks, Lockport, N.Y. See ad. p. 189.

4 to 40 H P. Steam Engines. See adv. p. 189.

Lightning Screw Plates and Labor-saving Tools, p. 190.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) O. V. D.—In replying to your query as to the proper strength for telephone magnets, in last issue of this paper, an obvious error occurs. The magnet should support three or four times its own weight, instead of three-fourths as there given.

(2) W. H. C. asks: 1. What kind of boiler and fuel should be used in close apartment to run a small engine without vitiating the air? A. You can use a tubular (upright) boiler with gas or alcohol lamps, but you should provide a pipe to carry off the products of combustion. 2. Also what is the best book for a student of mechanical drawing to begin with having no previous considerable knowledge of geometry or mathematics? A. Professor MacCord's drawing lessons in SCIENTIFIC AMERICAN SUPPLEMENT will meet your wants.

(3) W. P. asks if quicklime is a proper disinfectant for a cellar where milk is kept. A. Yes.

(4) W. writes: The exhaust pipe from a 200 horse power steam engine has a back pressure valve in it. The escaping steam, after passing the valve, makes a disagreeable noise. How can this be avoided cheaply? A. The noise will be very much reduced by surrounding the outlet or escape, with a wood pipe, 2 feet or 2½ feet diameter or square, and say 12 to 16 feet in length.

(5) W. H. W. asks: 1. Are not the continuous lines of metallic pipes for gas, water, etc., in city buildings a considerable protection from the injurious effects of lightning? A. Yes, they form an excellent and extensive ground. 2. Do they not render any severe injury to the inmates improbable by affording the electricity a ready escape to the earth? A. It is undoubtedly true that accidents have been averted by the presence of the pipes, and it is also true that the pipes afford so many avenues of escape for the lightning that under certain conditions the danger is increased. For example, suppose a person standing in the path of the lightning between the striking point and the nearest pipe, it is probable that he would be selected as a conductor. 3. Will not a metal roof with water conductors leading to drain afford some protection? A. Yes, to a certain extent, but if several good lightning rods were connected with the roof and well grounded by connecting their lower ends with the gas and water pipes, and by extending them eight or ten feet in a trench made in earth that is continually moist and filled with coke packed around the rod, your protection will be as good as it is possible to secure. 4. Would the risk from lightning be materially increased by placing a wooden pole, with an iron pin on top for a weather vane, two or three feet above a low chimney on a city house with gas and water pipes, metal roof, etc., but without a lightning rod? A. The risk would be increased. All elevated points are sources of danger unless provided with a good rod, well grounded.

(6) T. W. O. asks: 1. Can you give me a process of bleaching animal size, such as is used by paper makers? A. Try a small quantity of alum and sulphite of soda (freshly prepared). 2. What will prevent the forming of rosin size. The size is made of rosin and sal soda. A. A trace of fine sperm or olive oil will probably obviate the difficulty. An excess must be avoided.

(7) "Enterprise" asks: What tools, if any, is a machinist supposed to furnish, at his own expense, when in the employ of other parties? A. All of what are usually termed "hand" tools; but if any are lost or destroyed on the work they are chargeable, also all necessary repairs while used on the work are chargeable.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

August 24, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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Slates, manufacture of, R. A. Coffin, Slatington, Pa.
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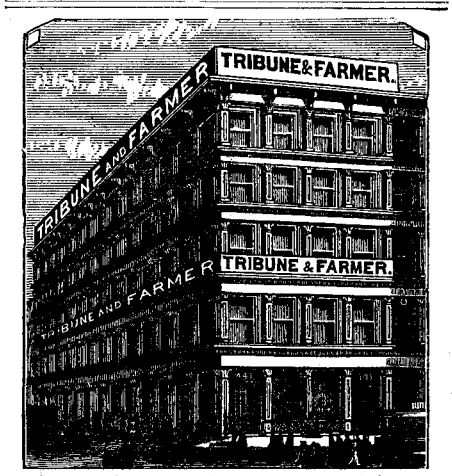

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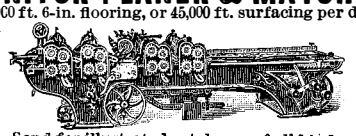

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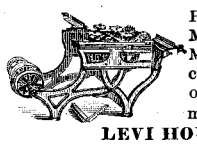

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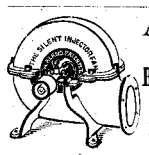

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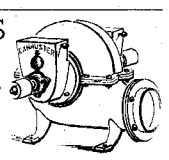

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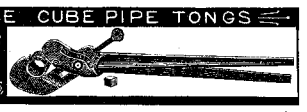

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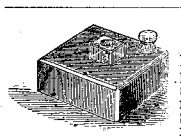

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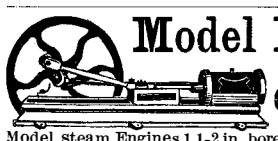

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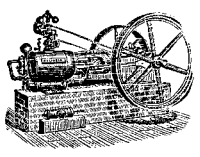

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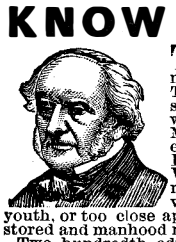

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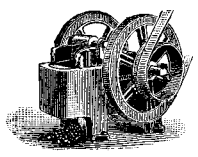

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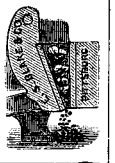

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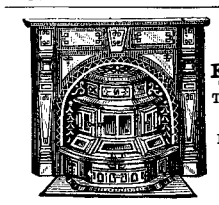

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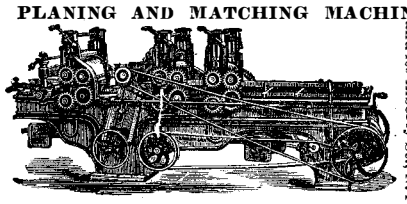

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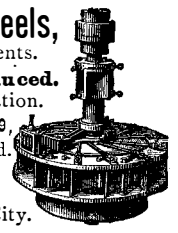

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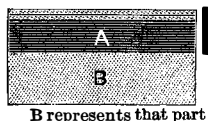

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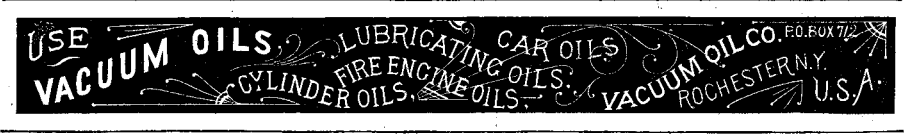

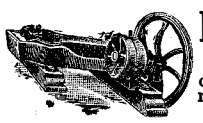

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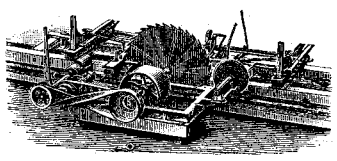

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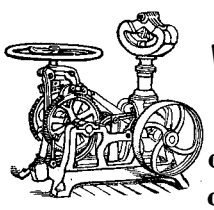

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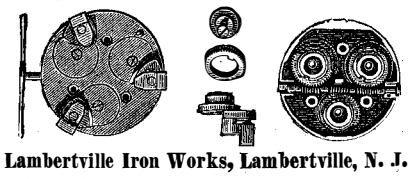

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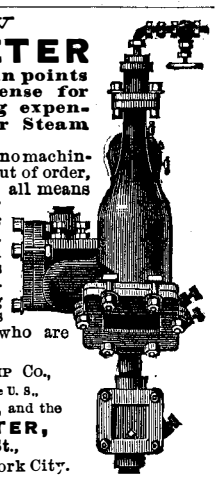

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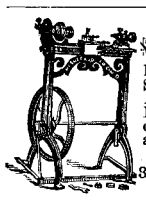

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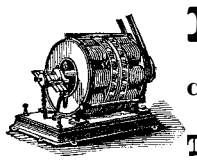

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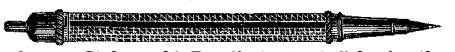

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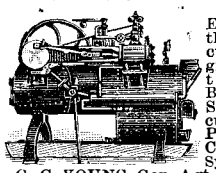

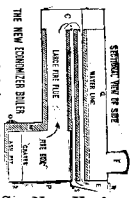

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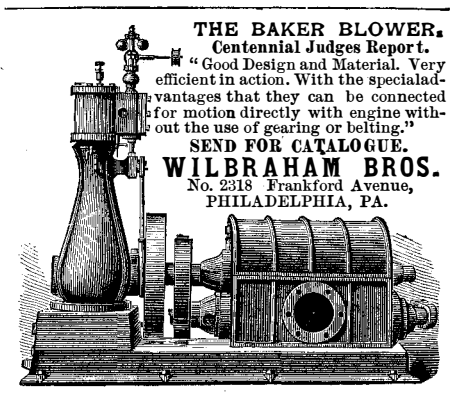

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